



Western Water Constructors, Inc.
Submittal Cover

Job no. 16-05



CONTRACT NAME: Manteca WQCF Digester Improvements
SPEC SECTION: 11374 Hermetically Sealed Multistage Gas Blowers
SUBMITTAL TITLE: Blower - O&M
FILE NAME: 172-R1_11374-03_Blower-OM

SUB #: 172
REV #: 1
CODE: 11374-03
DATE: 9/14/2017

WWC REVIEW/COMMENTS: **NO EXCEPTIONS** **EXCEPTIONS / DEVIATIONS AS NOTED**

REVIEWED BY: ST

SIGNED:

WWC HAS REVIEWED THIS SUBMITTAL FOR CONFORMANCE WITH THE PROJECT PLANS & SPECIFICATIONS.

OWNER REVIEW:

ITEM	DESCRIPTION	REVIEW STATUS				
		A	B	C	D	E
1	Blower O&M	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

LEGEND: **A** = No Exceptions Taken **B** = Make Correction Noted **C** = Correct & Resubmit
D = Rejected **E** = Accepted for Record

OWNER COMMENTS:

REVIEWER'S NAME: _____

REVIEWER'S SIGNATURE: _____

DATE: _____



OPERATING AND MAINTENANCE DATA

Project: City of Manteca, CA

Customer: Western Waters Constructors, Inc.

707 Aviation Boulevard

Santa Rosa, CA 95403

Purchase Order No.: 1605-18

Spec Section: 11374 Hermetically Sealed Multistage Gas Blower

Equipment Nos.: BIOG-BLR-07-621, 622, 623, 624

Catalog No.: GH-2505-H MOD **Quantity:** 4

Spencer Machine Nos.: 820299-302

Sales Order No.: 500927

Submittal Date: September 13, 2017 **Revision No.:** 1

Exclusive Spencer Wastewater Representative:

G3 Engineering, Inc.

5905 Granite Lake Drive

Suite 120

Granite Bay, CA 95746

Tel.: (916) 797-1880

Fax: (916) 797-1881

The Spencer Turbine Company

600 Day Hill Road, Windsor, CT 06095-4706 ♦ 800-232-4321 ♦ 860-688-8361 ♦ Fax 860-688-0098 ♦ www.spencerturbine.com

Blowers Gas Boosters Central Vacuum Systems Separators Tubing & Fittings Electrical Control Panels System Accessories



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3. Preliminary Performance Curve of a Spencer Model No. GH-2505-HMOD, Rev1
4. Spare Parts Kit
5. Fabcel Pads, PAD90019, 20, 21, 22, 25, 26, 29, 40
6. Adhesive Anchors, Part No. BLT500927P1
7. Anchor Installation Instructions for Part No. BLT500927P1
8. Spencer Hermetic Gas Booster General Instructions, Form GG7
9. Warranty Statement

2. MOTOR INFORMATION

1. Baldor-Reliance 5 HP Motor Nameplate Data
2. Baldor-Reliance Dimensional Drawing
3. Baldor-Reliance Wiring Diagram
4. Baldor-Reliance Installation & Operating Manual, MN408

3. MECHANICAL ACCESSORIES

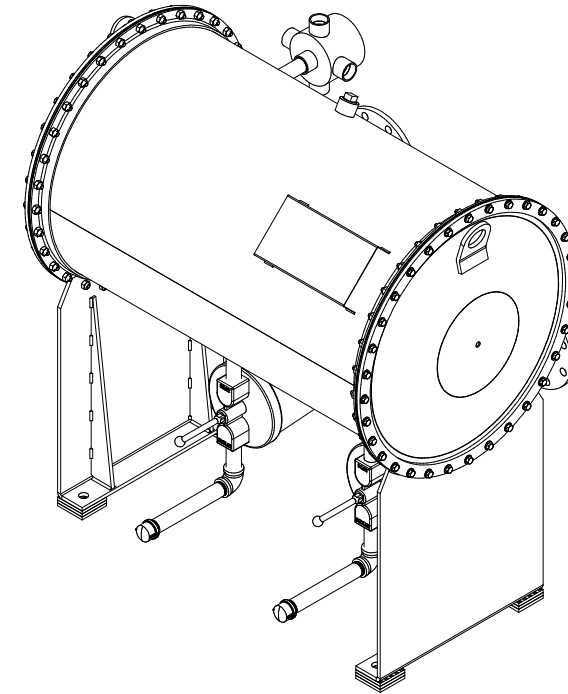
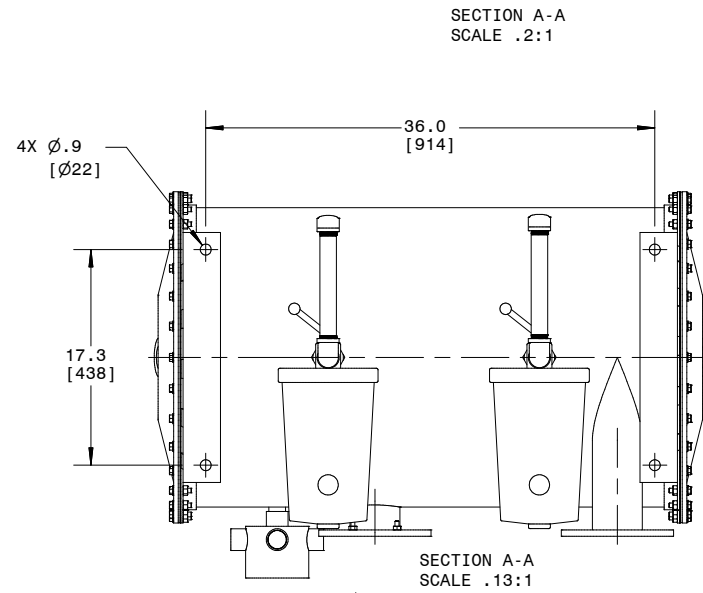
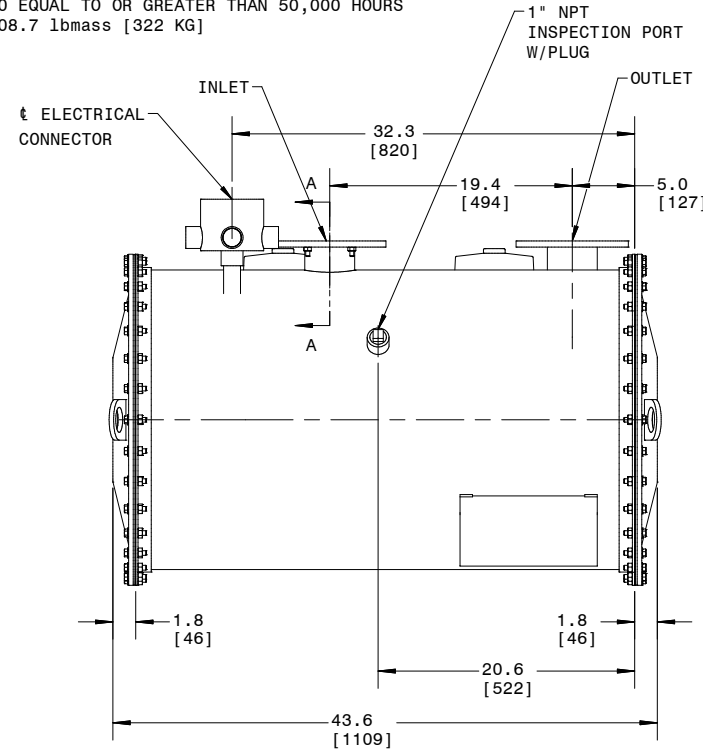
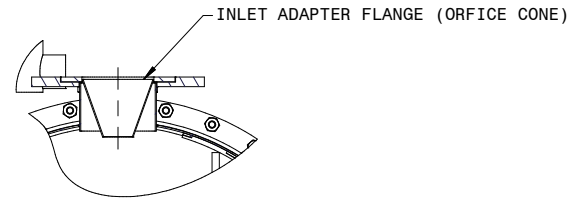
1. Flexi-Hinge Check Valve, Part No. VLV500927P
2. Operating & Maintenance for Check Valve, Part No. VLV500927P
3. Shand & Jurs Manual Drip Trap, Part No. VLV500927P1
4. Shand & Jurs Operating Manual for Part No. VLV50927P1

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM HERMETICALLY SEALED MULTISTAGE GAS BLOWER
2. MANUFACTURER SPENCER TURBINE
3. EQUIPMENT IDENTIFICATION NUMBER(S) BIOG-BLR-07-621, 622, 623 & 624
(maps equipment number)
4. LOCATION OF EQUIPMENT _____
5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____
EACH OF THE 4 BOOSTERS WEIGHS APPROXIMATELY 710 LBS
6. NAMEPLATE DATA - Horsepower 5 HP
Amperage 5.6 FLA
Voltage 460 V
Service Factor (S.F.) 1.15
Speed 3470 RPM
ENC Type XPFC
Capacity 130 SCFM
Other _____
7. MANUFACTURER'S LOCAL REPRESENTATIVE
Name Spencer Turbine Company
Address 600 Day Hill Road, Windsor, CT 06095
Telephone Number 860-688-8361 - ext 259 or ext 258
8. MAINTENANCE REQUIREMENTS The only requirement is that drip traps are periodically drained.
Motor bearings are permanently lubricated.
9. LUBRICANT LIST Motor Bearings are permanently lubricated.
10. SPARE PARTS (recommendations) Spare motor bearings and spare end head gasket were provided
per specifications. No additional spare parts are recommended.
11. COMMENTS _____

- NOTES:
 1. ALL DIMENSIONS ARE IN INCHES [MM]
 2. THIS EQUIPMENT IS DESIGNED TO SET ON ISOMODE PADS
 3. DO NOT TRANSMIT EXTERNAL WEIGHT OR STRESS TO THE CASING
 4. FLEXIBLE CONNECTIONS ARE RECOMMENDED
 5. FLANGED INLET AND OUT CONNECTIONS ARE ANSI B16.5 125#/150# DRILLING
 6. BOLT HOLES IN FLANGES STRADDLE THE NATURAL CENTERLINE OF INLET/OUT
 7. MOTOR BEARINGS ARE PERMANENTLY LUBRICATED
 8. BEARING LIFE: L10 EQUAL TO OR GREATER THAN 50,000 HOURS
 9. APPROX. WEIGHT: 708.7 lbmass [322 KG]

MATERIALS OF CONSTRUCTION:
 HOUSING: 304 SS
 IMPELLARS: ANODIZED ALUMINUM
 FLANGES: 304 SS
 SUPPORT LEGS: 304 SS
 END HEAD GASKETS: SHELLAR-GLOBE #HC-50 (CORK & SYNTHETIC RUBBER GASKET)



MOTOR DATA

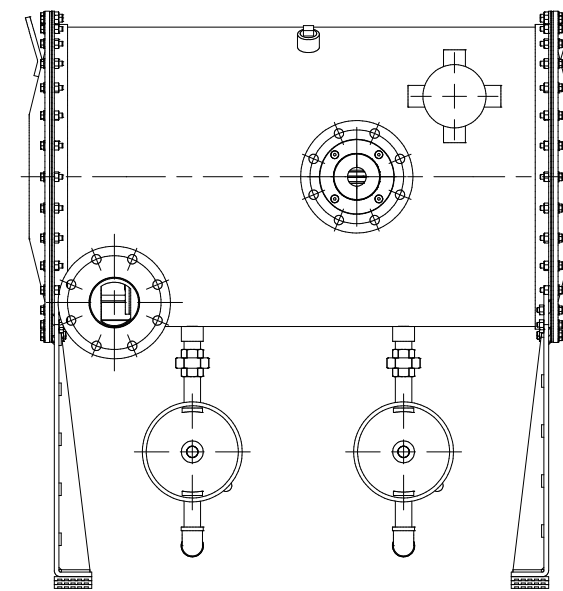
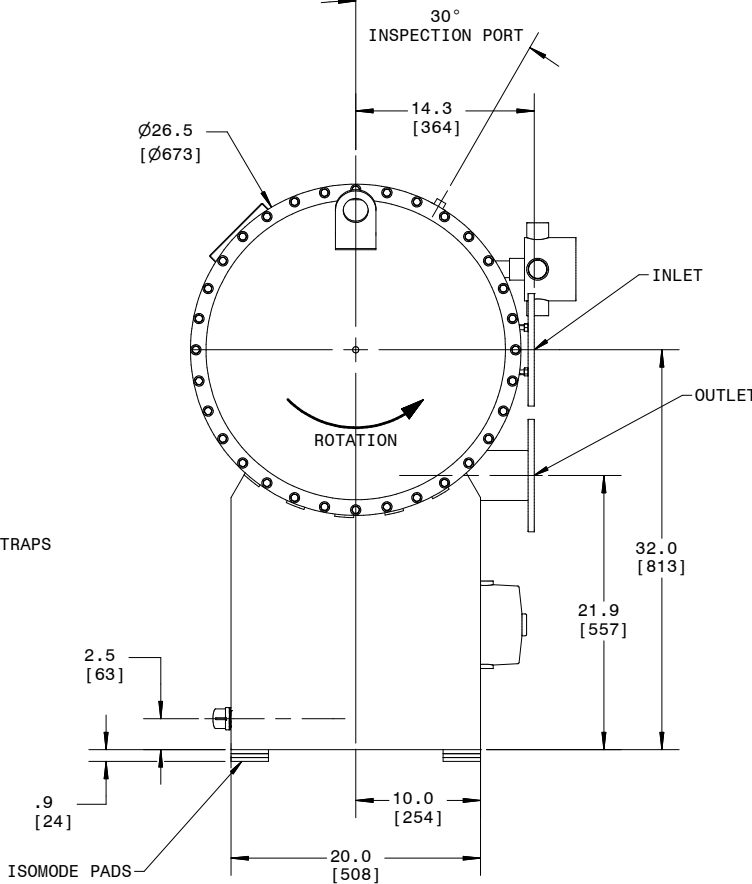
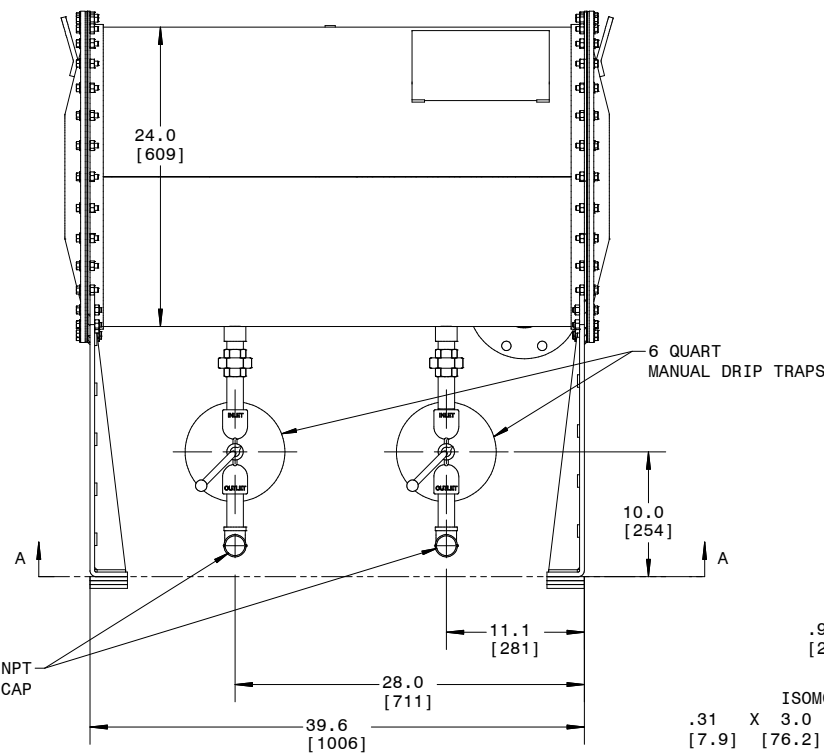
MAKE BALDOR
 HORSEPOWER 5 FRAME SIZE 184TY
 RPM 3550 VOLTAGE 460 O.V.
 PHASE 3 HERTZ 60
 ENCLOSURE TYPE EXP. PROOF

PERFORMANCE DATA

RATED 130 SCFM
 INLET TEMP. 100 °F
 INLET PRESSURE 14.14 PSIA
 DIFFERENTIAL PRESSURE 2.54 PSIG
 DISCHARGE PRESSURE 16.68 PSIA
 SPECIFIC GRAVITY .8
 ALTITUDE 25 FT. ABOVE S.L.

DIMENSIONS CERTIFIED FOR:

INSTALLATION MANTECA, CA
 CUSTOMER WESTERN WATERS CONSTRUCTORS, INC
 CUSTOMER ORDER No. LOI
 SALES ORDER No. 500927
 SERIAL No. 820299-302
 MODEL No. GH-2505-H MOD
 INLET: POS. RADIAL SIZE 4 (T/F): FLANGE
 OUTLET: POS. 3 SIZE 4 (T/F): FLANGE



ISOMODE PADS
 .31 X 3.0 X 3.0
 [7.9] [76.2] [76.2]
 (12) REQ'D. TOTAL
 STACKED (3) HIGH

SPECIAL MATERIAL
 INSPECTION REQUIRED
 PROCEDURE 0003
 TYPE: 304L SS

CONTROLLED CUSTOM
 PRINT
 PROJECT NO. 500927
 MACHINE NO. 820299-302
 BJP 8/11/2017

DRAWING STATUS: RELEASED

THIS DOCUMENT AND INFORMATION CONTAINED HEREIN IS PROPRIETARY TO THE SPENCER TURBINE CO. AND SHOULD NOT BE USED, COPIED OR DISCUSSED TO OTHERS, EXCEPT AS SPECIFICALLY AUTHORIZED IN WRITING BY THE SPENCER TURBINE CO.

THE SPENCER TURBINE COMPANY
 WINDSOR, CT. 06095

TITLE: 24" HERMETIC GAS BOOSTER
 CAT. No. GH-2505-H MOD

SIZE D DWG. NO. 500927P REV. 3

DR. BY	BJP	CK'D BY	ENG.	ECN
DATE	1/20/2017	DATE		
SCALE:	.13:1	SHEET	1	OF 1

NO.	DESCRIPTION	ECN	DATE	DR. BY	CK'D
3	CHANGED TO ISOMODE PADS WAS CORK, ADDED INLET ADAPTER FLANGE (ORFICE CONE)	CO# 5	8/11/2017	BJP	-
2	ADDED APPROX. WEIGHT	CO#4	07/20/2017	BJP	-
1	UPDATED PER CHANGE ORDER #2 (ADDED BEARING DATA AND MATERIALS OF CONSTRUCTION)	CO#2	06/01/2017	BJP	-

The Spencer Turbine Co., Windsor, CT, U.S.A.

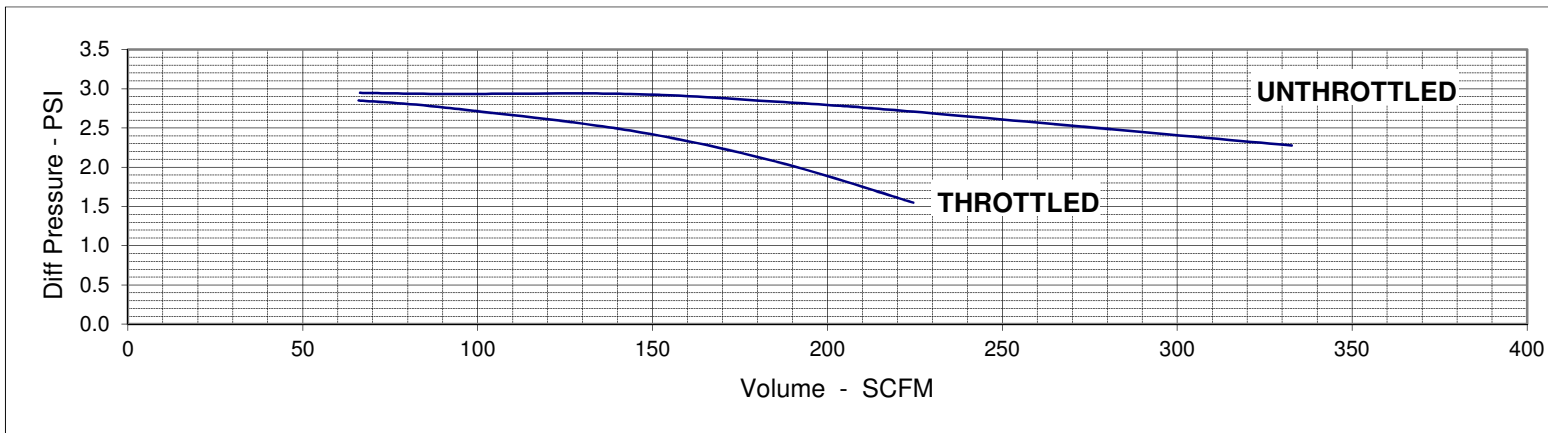
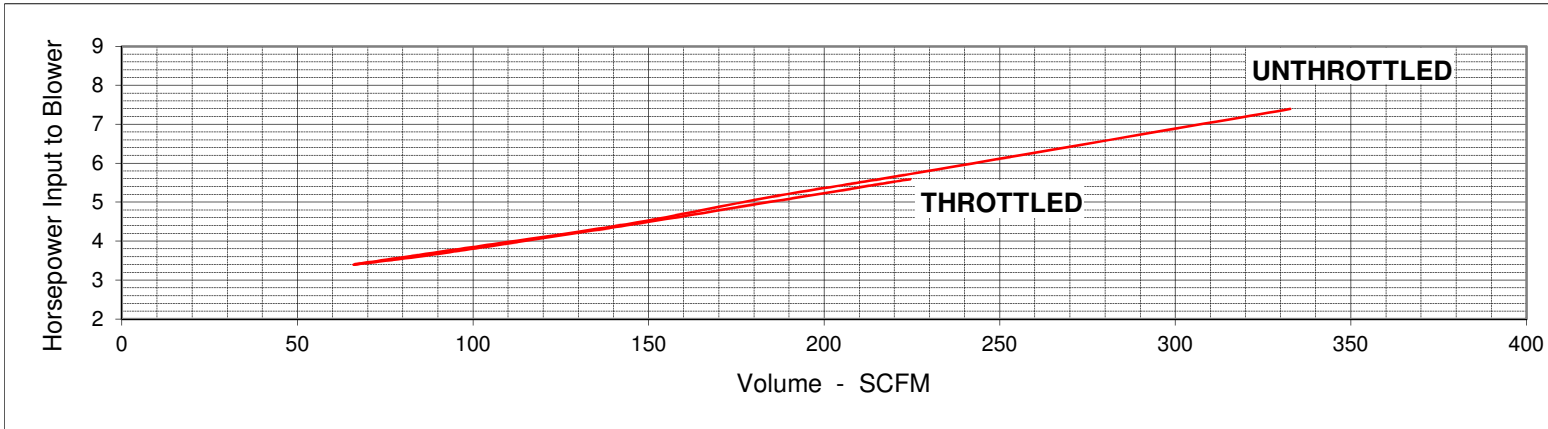
PRELIMINARY INLET THROTTLED PERFORMANCE CURVE OF A SPENCER MODEL # GH-2505-H MOD

Rated	143 ICFM	130	SCFM
Inlet Temperature		100	Deg. F
Inlet Pressure		14.14	PSIA

GAS	DIGESTER
S.G.	0.8
K-Value	1.3

Motor	
	5 HP
	3550 RPM

Inlet Pressure = -15" W.C., Discharge Pressure = 2.0 PSIG (Designed with (7) 16-3/4" x 1/2" Fans)



The Spencer Turbine Company
 600 Day Hill Road, Windsor, Connecticut 06095
 Telephone (860) 688-8361 Fax (860) 688-0098

PROVIDED SPARE PARTS KIT

Spencer Machine Number 820299-302	Customer Name WESTERN WATERS CONSTRUCTORS INC.	Date 1/26/2017
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Quantity	Item
2	BRG500927P BEARINGS (1) ONE SET PERMANENTLY SEALED BEARING (2) BEARINGS PER SET
2	GSK90004 END HEAD GASKETS (1) SET HOUSING END HEAD GASKETS
NO SPECIAL TOOLS REQUIRED	
<p>ALL INFORMATION-COMMUNICATION, CORRESPONDENCE, DRAWINGS, DESIGN CRITERIA, ETC. USED IN ESTABLISHING THIS PROPOSAL/QUOTATION, IS CONFIDENTIAL AND PREPARED FOR THE SOLE USE OF WESTERN WATERS CONSTRUCTORS, INC. IN THEIR CONSIDERATION FOR PURCHASES OF SPENCER TURBINE EQUIPMENT. TRANSMISSION OF ANY PART OR ALL OF THIS INFORMATION TO OTHERS OR USE BY WESTERN WATERS CONSTRUCTORS, INC. OR ANY OTHER PURPOSE IS UNAUTHORIZED WITHOUT WRITTEN CONSENT FROM THE SPENCER TURBINE COMPANY.</p>	

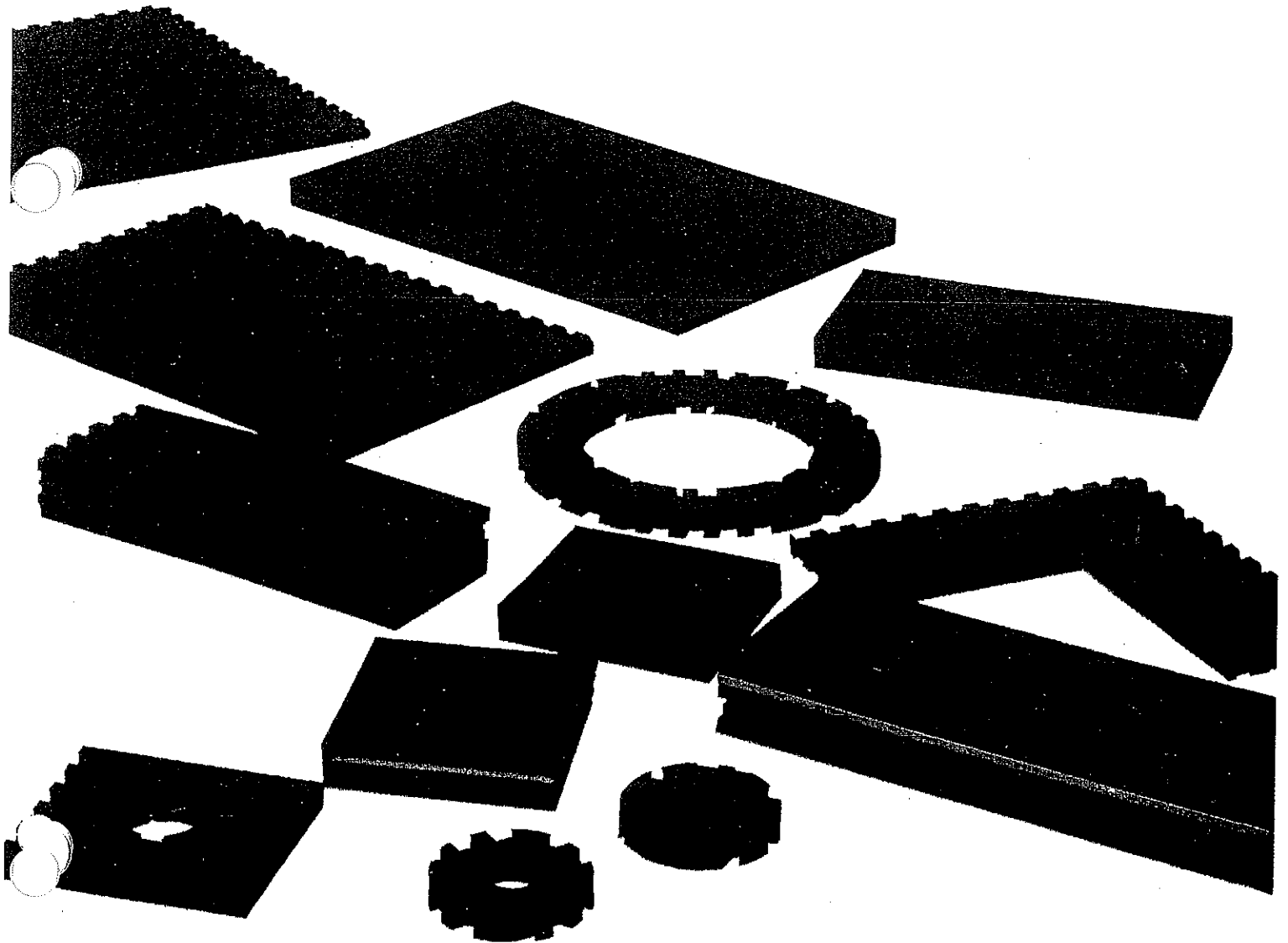
Terms are net (30) days, F.O.B. Windsor, Connecticut

STANDARD SPENCER TERMS AND CONDITIONS APPLY

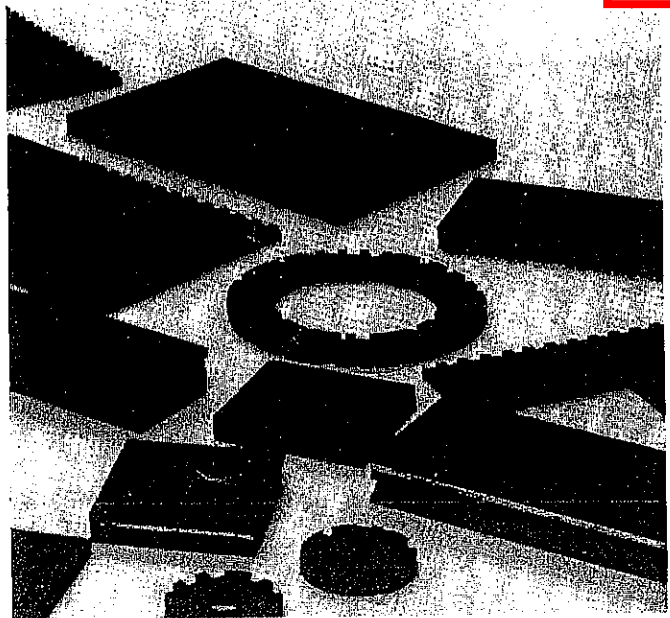
FABCEL PADS

By FABREEKA International, Inc.

FOR REDUCTION OF LOW FREQUENCY VIBRATION



HOW FABCEL FUNCTIONS IN REDUCING LOW FREQUENCY VIBRATION



FABCEL 25, 50 and 100

FABCEL is a high quality neoprene,* molded into scientifically designed pads measuring 18" x 18" (457mm x 457mm). The pad surfaces have molded recessed offset-cells to allow flow of rubber when under load while maintaining lateral stability. This design eliminates the shape factor usually associated with elastomeric pads and provides positive grip to machine foot and foundation when under load.

FABCEL Pads are available in thicknesses of 5/16" (8mm) and 1/2" (13mm) and each in a hardness of 25, 50 and 70 Durometer. FABCEL Pads can be cut to size to suit any requirement up to 18" (457mm). For widths or lengths greater than 18" (457mm) simply place the positive grip, cellular designed FABCEL Pads side by side.

MAXIMUM LOADS

FABCEL Pads are rated for load and thickness as follows:

25 PSI (0.18 MPa)–FABCEL 25	5/16" th. (8mm)
50 PSI (0.35 MPa)–FABCEL 50	5/16" th. (8mm)
100 PSI (0.69 MPa)–FABCEL 100	5/16" th. (8mm)
200 PSI (1.40 MPa)–FABCEL 200	1/2" th. (13mm)
300 PSI (2.10 MPa)–FABCEL 300	1/2" th. (13mm)

PHYSICAL PROPERTIES

Test results were obtained using ASTM Standard Specimens and are as follows:

FABCEL PADS	50 and 200	100 and 300
Hardness Durometer	50 ± 5	70 ± 5
Tensile Strength	2000 PSI	2000 PSI
Elongation	350%	220%
Resilience	52%	60%
Damping C/Cc-(Avg.)	6%	6%

RESISTANCE TO WATER, OIL AND HEAT

FABCEL Pads are resistant to most oils, water, steam and chemicals. FABCEL 50C is available for special applications requiring oil proof compounds. Consult with FABREEKA'S ENGINEERING DEPARTMENT for specific recommendations. Maximum temperature limits for continuous exposure for FABCEL Pads are 200°F (95°C) except FABCEL 25 which is 150°F (65°C).

FABCEL Pads are comprised of organic materials and properties may vary from lot to lot. All technical values contained in this literature are averages

and can vary depending upon test procedures. Please consult Fabreeka's Engineering Department for design assistance at 1-800-322-7352.

THEORY AND PRACTICE

When the disturbing frequency is low, a soft FABCEL Pad is required to provide greater isolation. Multiple layer FABCEL mounts are used to isolate lower than normal disturbing frequencies.

DETERMINING THE PROPER FABCEL ISOLATOR

The first consideration is to select the correct FABCEL Pad. The machine weight, disturbing frequency and bearing area of the machine feet or support must be determined. The weight must be converted to PSI (MPa) based on the support area size. Referring to the paragraph headed Maximum Load, the proper FABCEL Pad can be determined.

The following example illustrates the procedure for designing a FABCEL isolator:

Machine Weight = 7,200 lbs (32 027 N)
 Feet/Supports = 4 ea. 6" x 6" (152mm x 152mm)
 Operating Speed = 1,200 RPM – 20 CPS

ENGLISH	METRIC
$\frac{7,200}{4} = 1,800 \text{ lbs.}$	$\frac{32\,027}{4} = 8007 \text{ N}$
$\frac{1,800}{36 \text{ in}^2} = 50 \text{ PSI}$	$\frac{8007 \text{ N}}{22\,877 \text{ mm}^2} = 0.35 \text{ MPa}$

Use 4 pads 6" x 6" (152mm x 152mm) FABCEL 50.

The percent reduction in transmitted vibration for this example can be calculated. A minimum frequency ratio of 2 is needed to obtain acceptable isolation.

$$\frac{F_f}{N_f} = 2$$

Then:

$$N_f = \frac{F_f}{2} = \frac{20 \text{ CPS}}{2} = 10 \text{ CPS (Hertz)}$$

Referring to the FABCEL Transmissibility Tables for FABCEL 50, the percent reduction in transmitted vibration is for 1 layer 0%, 3 layers 15%, 6 layers 69% and 9 layers 82%.

*FABCEL 25 is nitrile.

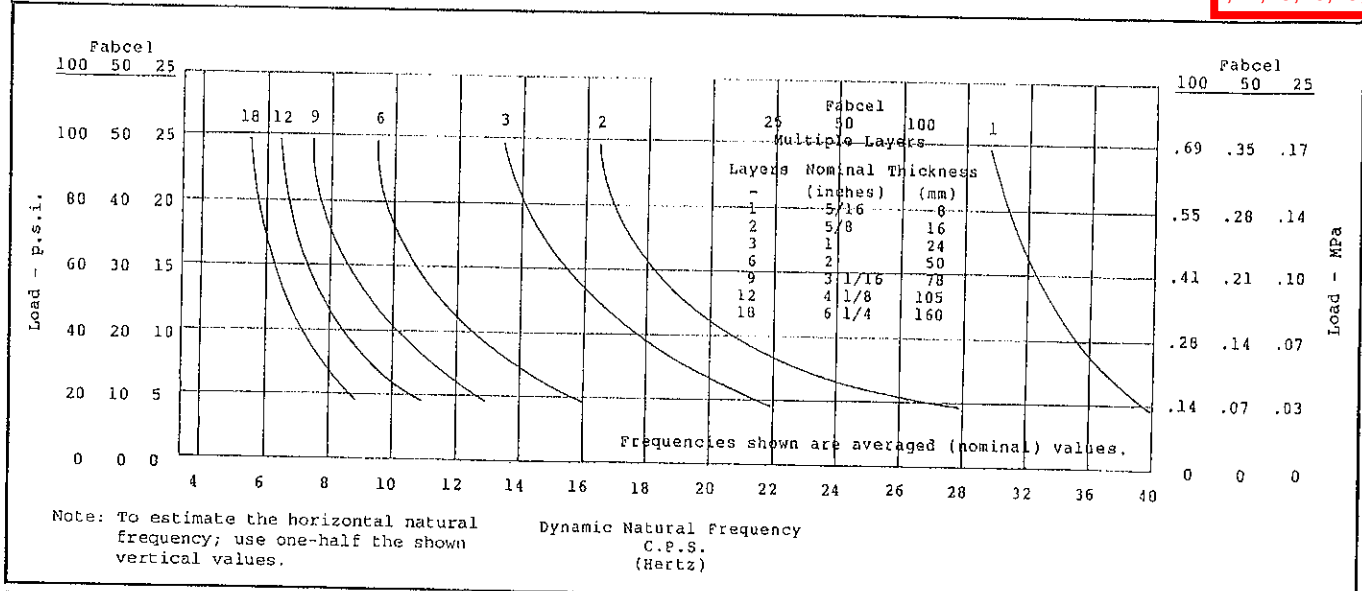


Figure 1. Dynamic Natural Frequency

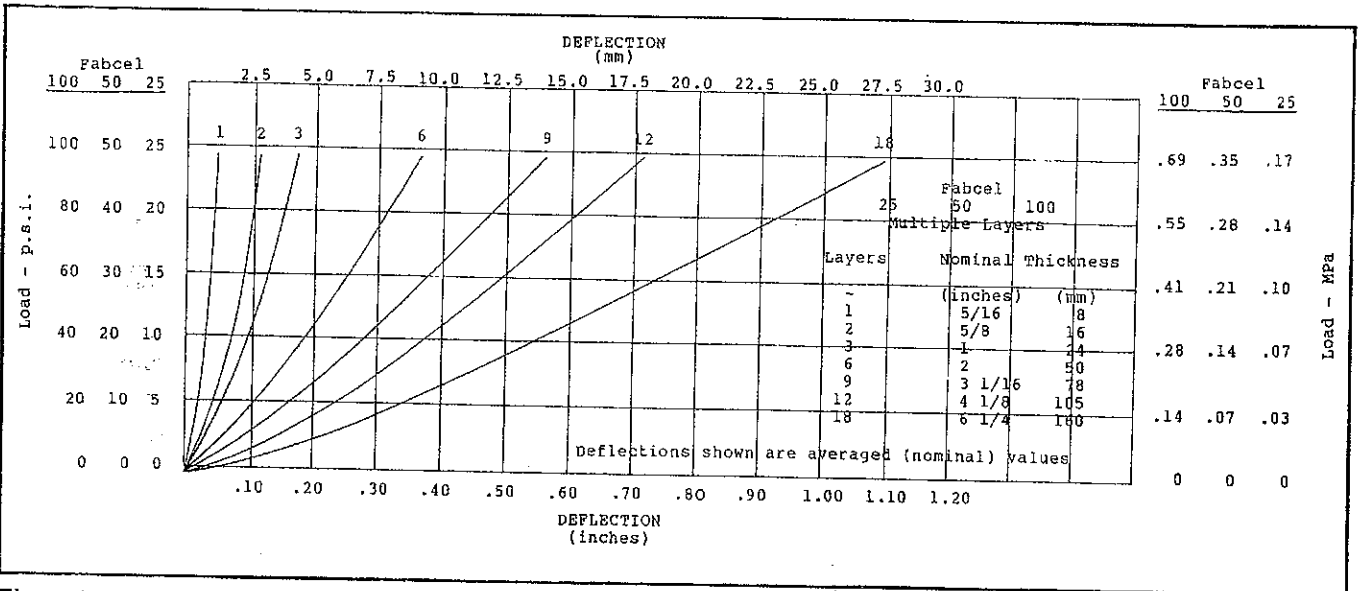


Figure 2. Load Deflection

MULTIPLE LAYERS

When the disturbing frequency is very low and the isolation requirements are critical, multiple layer mounts of FABCEL Pads are necessary.

Multiple layer mounts are supplied with a FABREEKA Pad located every 3rd layer for added strength and stability. The layers are integrally bonded together.

The addition of FABREEKA pads, while adding excellent high frequency isolation, controls lateral flow of rubber and vertical deflection to stabilize the relatively tall isolation mount.

FABCEL's cellular design permits a larger deflection under load than a solid rubber material of the same thickness. This results in lower natural frequency and greater isolation.

FABCEL multiple layer isolators can be placed directly under a machine or its support. If a narrow structural steel member is used as a machine support or base, it may be necessary to increase the isolator support area by including a steel load distributing plate at each isolator location or one large plate for all isolators. Good design of multiple layer isolators requires that mounts should not be narrower than twice the thickness.

SPRING RATE

The Spring Rate Formula for all thicknesses of FABCEL Pads is as follows:

$$K = \text{SRF} \times \text{Pad Area}$$

ENGLISH

$$K = \frac{\text{lbs}}{\text{in}}$$

METRIC

$$K = \frac{\text{N}}{\text{m}}$$

The following spring rate factor formulas and example will allow you to determine FABCEL's spring rate for various loadings, pad size and thickness.

Elastomers respond differently under dynamic conditions. They act stiffer under dynamic conditions than under static conditions.

Static

The static spring rate factor is determined from the slope of the load deflection curve or estimated from the dynamic spring rate factor. The average static rate is 40% of the dynamic rate.

Dynamic

The dynamic spring rate factor is calculated as follows, using the Frequency value shown on Fig. 1:

$$\text{DSRF} = 0.10 \times (\text{Dynamic Natural Frequency})^2 \times \text{stress}$$

A typical example using FABCEL 50 is as follows:

ENGLISH		METRIC
50 psi	Load	0.35 MPa
10" x 10"	Area	0.254m x 0.254m
9 layers	Thickness	9 layers
7.5 Hertz	Dynamic Natural Frequency	7.5 Hertz

Dynamic Spring Rate Factor (DSRF)

DSRF = 0.10 x (Dynamic Natural Frequency)² x stress
 DSRF = 0.10 x (7.5)² x 50
 DSRF = 280 $\frac{\text{psi}}{\text{in}}$

280 $\frac{\text{psi}}{\text{in}}$	DSRF	79 $\frac{\text{MPa}}{\text{m}}$
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Kd = Dynamic Spring Rate
 Kd = (DSRF) x Pad Area

$Kd = 280 \frac{\text{Lbs}}{\text{in}} \times 100 \text{ in}^2$ $Kd = 79 \times 10^6 \frac{\text{N}}{\text{m}^2} \times 0.645 \text{ m}^2$
 $Kd = 28,000 \frac{\text{Lbs}}{\text{in}}$ $Kd = 5,100,000 \frac{\text{N}}{\text{m}}$

Static Spring Rate Factor (SSRF)

SSRF = Slope of Load-Deflection Curve
 $SSRF = \frac{50-40 \text{ psi}}{0.56 - 0.47 \text{ in}} = \frac{10}{0.095}$
 $SSRF = 105 \frac{\text{psi}}{\text{in}}$

105 $\frac{\text{psi}}{\text{in}}$	SSRF	29 $\frac{\text{MPa}}{\text{m}}$
Ks = Static Spring Rate		
Ks = (SSRF) x Pad Area		
$Ks = 105 \frac{\text{Lbs}}{\text{in}} \times 100 \text{ in}^2$	$Ks = 29 \times 10^6 \frac{\text{N}}{\text{m}^2} \times 0.645 \text{ m}^2$	
$Ks = 10,500 \frac{\text{Lbs}}{\text{in}}$	$Ks = 1,871,000 \frac{\text{N}}{\text{m}}$	

Inertia Block Isolation

Multiple layer FABCEL Isolators in combination with an inertia block are an ideal solution for the reduction of vibration and shock on critical installations. Contact Fabreeka Engineering at 1-800-322-7352 for details or assistance.

FABCEL 200 and 300

Rubber is essentially an incompressible substance that deforms by changing shape rather than volume. As a result, the load-deflection curve is greatly influenced by the shape factor (S.F.) of the pad used; i.e., whether the pad is relatively tall with a small cross section, or relatively short with a large cross section.

Under practical conditions the shape factor effect of FABCEL 25, 50 or FABCEL 100 is minimal and can be disregarded.

Under certain conditions FABCEL 200 and FABCEL 300 exhibit a shape factor effect, although not as pronounced as would be the case in normally used elastomeric materials.

For greater load carrying capacity consider FABCEL 200/300

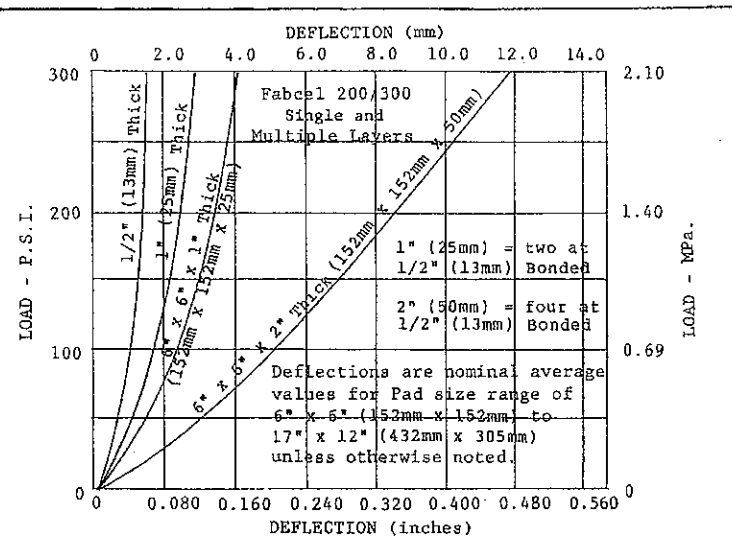


Figure 3. Load Deflection

Typical Spring Rate example using FABCEL 200/300

ENGLISH	Load	METRIC
300 psi	Area	2.05 MPa
6" x 6"		0.152m x 0.152m
2 layers (1")	Thickness	2 layers (25mm)
20 Hertz	Dynamic Natural Frequency	20 Hertz

Dynamic Spring Rate Factor (DSRF)

DSRF = 0.10 x (Dynamic Natural Frequency)² x stress (psi)
 DSRF = 0.10 x (20)² x 300
 DSRF = 12,000 $\frac{\text{psi}}{\text{in}}$

DSRF = 4.0 x (Dynamic Natural Frequency)² x stress (MPa)
 DSRF = 4.0 x (20)² x 2.05
 DSRF = 3280 $\frac{\text{MPa}}{\text{m}}$

12,000 $\frac{\text{psi}}{\text{in}}$	DSRF	3280 $\frac{\text{MPa}}{\text{m}}$
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Dynamic Spring Rate

Kd = Dynamic Spring Rate
 Kd = (DSRF) x Pad Area

$Kd = 12,000 \frac{\text{Lbs}}{\text{in}} \times 36 \text{ in}^2$ $Kd = 3280 \times 10^6 \frac{\text{N}}{\text{m}^2} \times 0.23 \text{ m}^2$
 $Kd = 432,000 \frac{\text{Lbs}}{\text{in}}$ $Kd = 75,400,000 \frac{\text{N}}{\text{m}}$

Static Spring Rate Factor (SSRF)

SSRF = Slope of Load-Deflection Curve
 $SSRF = \frac{300-200 \text{ psi}}{0.160 - 0.135 \text{ in}} = \frac{100}{0.025}$
 $SSRF = 4000 \frac{\text{psi}}{\text{in}}$

4000 $\frac{\text{psi}}{\text{in}}$	SSRF	1093 $\frac{\text{MPa}}{\text{m}}$
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Static Spring Rate

Ks = Static Spring Rate
 Ks = (SSRF) x Pad Area

$Ks = 4000 \frac{\text{Lbs}}{\text{in}} \times 36 \text{ in}^2$ $Ks = 1093 \times 10^6 \frac{\text{N}}{\text{m}^2} \times 0.23 \text{ m}^2$
 $Ks = 144,000 \frac{\text{Lbs}}{\text{in}}$ $Ks = 25,100,000 \frac{\text{N}}{\text{m}}$

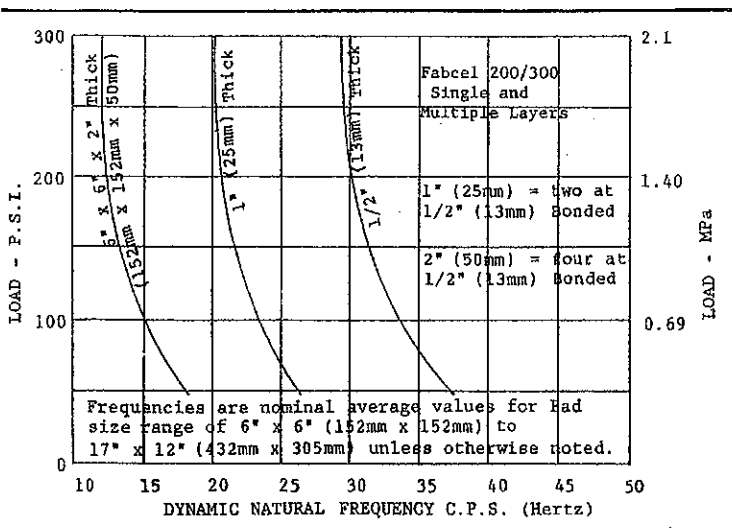


Figure 4. Dynamic Natural Frequency

PERCENT REDUCTION IN TRANSMITTED VIBRATION FOR FABCEL 25, 50, 100, 200 and 300

FABCEL 25, 50 and 100																					
Forcing Frequency C.P.S. (Hertz)	Fabc 25 50 100	1 Layer 5/16" (8mm) Thick LOAD-PS.I.					2 Layers 5/8" (16mm) Thick LOAD-PS.I.					3 Layers 1" (24mm) Thick LOAD-PS.I.					6 Layers 2" (50mm) Thick LOAD-PS.I.				
		5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25
		10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
20		--	--	--	--	--	--	--	--	--	--	--	--	--	15	--	35	55	65	69	
30		--	--	--	--	--	12	37	47	55	--	47	62	68	73	59	77	83	86	87	
40		--	--	--	--	3	63	71	75	78	55	75	81	83	86	79	88	90	92	93	
50		--	--	13	30	43	53	78	83	85	86	74	85	88	89	91	87	92	94	94	95
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70		50	61	68	72	76	79	89	91	92	93	88	92	93	94	95	93	95	96	97	97
80		65	72	76	79	82	85	92	93	94	94	90	94	95	95	96	94	96	97	97	97
90		74	79	82	84	86	88	93	94	95	95	92	95	96	96	96	95	97	97	98	98
100		79	83	85	87	89	90	94	95	96	96	94	96	96	97	97	96	97	98	98	98
120		86	88	90	91	92	93	96	96	97	97	95	97	97	97	98	97	98	98	98	98

Forcing Frequency C.P.S. (Hertz)	Fabc 25 50 100	9 Layers 3 1/16" (78mm) Thick LOAD-PS.I.					12 Layers 4 1/8" (105mm) Thick LOAD-PS.I.					15 Layers 5 3/16" (132mm) Thick LOAD-PS.I.					18 Layers 6 1/4" (160mm) Thick LOAD-PS.I.				
		5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25
		10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
10		--	--	--	--	--	--	--	3	26	--	--	4	26	42	--	3	26	42	55	
20		26	65	76	79	82	55	76	82	85	87	66	80	85	87	89	73	85	87	89	90
30		75	86	90	91	92	83	90	92	93	94	87	91	93	94	95	89	93	94	94	95
40		87	92	94	94	95	90	94	95	96	96	92	95	96	96	97	93	96	96	96	97
50		91	94	96	96	96	94	96	96	97	97	95	96	97	97	98	95	97	97	97	98
60		94	96	97	97	97	95	97	97	97	98	96	97	98	98	98	96	97	98	98	98
70		95	97	97	97	98	96	97	98	98	98	97	98	98	98	98	97	98	98	98	98
80		96	97	98	98	98	97	98	98	98	98	98	98	98	98	98	98	98	98	98	98
90		98	97	98	98	98	97	98	98	98	98	98	98	98	98	99	98	98	98	99	99
100		97	98	98	98	98	98	98	98	98	99	98	98	99	99	99	98	98	99	99	99
120		98	98	98	99	99	98	98	99	99	99	98	99	99	99	99	98	99	99	99	99

FABCEL 200 and 300													
Forcing Frequency C.P.S. (Hertz)	Fabc 200 300	1 Layer 1/2" (13mm) Thick LOAD-PS.I.				2 Layers 1" (25mm) Thick LOAD-PS.I.				4 Layers 2" (50mm) Thick LOAD-PS.I.			
		50	100	200	---	50	100	200	---	50	100	200	---
		50	100	200	300	50	100	200	300	50	100	200	300
20		--	---	---	---	--	---	---	---	--	---	---	---
30		--	---	---	---	--	---	---	---	32	59	76	80
40		--	---	---	---	16	43	61	66	70	80	87	89
50		--	13	42	48	58	69	78	80	82	88	92	93
60		32	51	65	68	74	80	85	86	88	91	94	95
70		57	68	76	78	81	85	89	90	91	94	96	96
80		70	76	82	84	86	89	91	92	93	95	96	97
90		77	82	86	87	89	91	93	94	94	96	97	97
100		82	85	89	90	91	93	94	95	95	96	97	98
110		85	88	91	92	93	94	95	96	96	97	98	98
120		87	90	92	93	94	95	96	96	97	97	98	98

Transmissibility can be calculated using the following formula:

Percent Reduction = 100 x

$$1 - \frac{1}{\left(\frac{\text{Forcing Frequency}}{\text{Resonant Frequency}} \right)^2 - 1}$$

Fabreeka's headquarters are in Stoughton, MA, a short distance from Boston.



Partial Customer List

- AEROJET
- ALCOA
- ALLEN BRADLEY
- ARCO
- ASEA
- BATH IRON WORKS
- BECHTEL CORPORATION
- BEECH AIRCRAFT
- BELL AEROSPACE
- BETTLEHEM STEEL
- BHARAT DYNAMICS
- BISS
- BOEING
- BOMBARDIER
- BOSTON DIGITAL
- BRIGGS & STRATTON
- BRITISH STEEL
- BROWN & ROOT
- BROWN & SHARPE
- BROWN & BOVERI
- BUDD
- CARRIER
- CHAMBERSBURG
- CHARMILLES ANDREWS
- CHRYSLER CORPORATION
- CINCINNATI INC.
- CINCINNATI MILACRON
- CLARK EQUIPMENT
- COMBUSTION ENGINEERING
- CSIST
- COOPER ENERGY
- DOMINION BRIDGE
- DEVLIEG
- DRESSER INDUSTRIES
- EATON CORPORATION
- ELOY
- ERIE PRESS
- FMC
- FARREL
- FLUOR
- FORD
- G.C.A.
- GENERAL DYNAMICS
- GENERAL ELECTRIC
- GENERAL MOTORS
- GOODYEAR AEROSPACE
- HAMILTON STANDARD
- HARLEY DAVIDSON
- HARRIS CORPORATION
- HEWLETT PACKARD
- HILL ACME
- HYD SUNG
- HUGHES AIRCRAFT
- HYSTER
- IBM
- IIT
- INGERSOLL MILLING
- INGERSOLL RAND
- JONES & LAMSON
- KEARNEY & TRECKER
- L. K. TOOL
- LANDIS TOOL
- LITTON
- LOCKHEAD
- LODGE SHIPLEY
- LUFKIN IND.
- MTS
- MACK TRUCK
- MARTIN MARIETTA
- MCDONNELL DOUGLAS
- MECHANICAL TECHNOLOGY
- MEMOREX
- MICRO ELECTRONICS
- MINSTER MACHINE
- MITSUBISHI
- NEWPORT NEWS
- NORTHROP
- NUMEREX
- OPEL
- OZA INSPECTIONS
- OLIVETTI
- PEUGOT
- POLAROID
- PRATT & WHITNEY
- RCA
- RAYTHEON
- RAPHAEL
- HEXNORD
- ROCHESTER PRODUCTS
- ROCKWELL INTERNATIONAL
- ROHR CORPORATION
- SAMSUNG
- SASIB
- SATURN
- SEAMLESS TUBES
- SIEMENS-ALLIS
- SIEMENS ENERGY
- SIKORSKY
- SIP
- SOLAR
- SPERRY SYSTEMS
- STEARNS ROGER
- STELCO
- TELEDYNE
- TOLEDO SCALE
- UNION CARBIDE
- U.S. STEEL
- VARIAN
- VENSON
- WILD-LEITZ
- WESTINGHOUSE
- WORTHINGTON
- WYMAN GORDON

For additional information or application assistance, contact your nearest Fabreeka Facility listed below:

Sales and Service Facilities



Headquarters:
P.O. Box 210, 1023 Turnpike Street
Stoughton, MA 02072
Tel: 1-800-322-7352
or: (781) 341-3655
Fax: (781) 341-3983
e-mail: info@fabreeka.com

Canada
Fabreeka-Canada Ltd.
2907 Portland Drive
Oakville, ON L6H 5S4
Tel: (800) 322-7352
Fax: (781) 341-3983
e-mail: info@fabreeka.com

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Fax: (31) 2531-12830
e-mail: info@fabreeka.nl

Germany
Fabreeka Deutschland GmbH
Hessenring 13 (D-64572)
Postfach 103
D-64570 Büttelborn GERMANY
Tel: (49) 6152-9597-0
Fax: (49) 6152-9597-40
e-mail:
info@fabreeka.de



Web Site - <http://www.fabreeka.com>

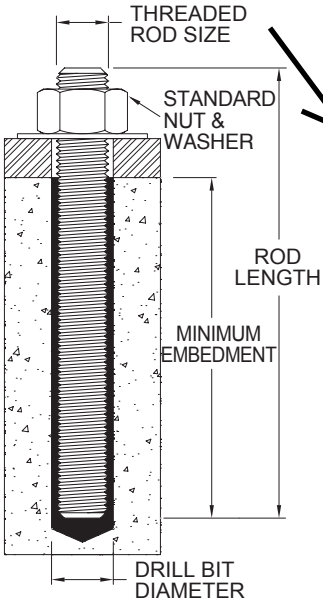
ADHESIVE ANCHORS

SRA

**A193 GRADE B8 STAINLESS STEEL
(TYPE 18-8, 304) THREADED ROD**

TYPE SRA ANCHOR DATA

Type and Size	Threaded Rod Size	Rod Length (in) (mm)	Embedment Depth (in) (mm)	Drill Bit Dia (in)	Minimum Concrete Thickness (in) (mm)	Maximum Tightening Torque After curing (Ft-lbs) (N-m)	Number of Anchors that can be installed per 22oz of adhesive
SRA-1/2	1/2-13 UNC	7 178	5 127	5/8	7 1/2 190	20 27	30
SRA-5/8	5/8-11 UNC	8 203	6 152	3/4	9 1/4 235	30 41	20
SRA-3/4	3/4-10 UNC	9 229	7 178	7/8	10 3/4 273	45 61	14
SRA-1	1-8 UNC	11 280	9 229	1 1/8	14 355	80 108	7



CURE SCHEDULE

Concrete Temperature	Cure Time
°F °C	(Hrs.)
50 10	72
70 21	24
90 32	24
110 43	24

For combined allowable stress design tension and shear forces on anchors, use the following equation:

$$\frac{T_{Applied}}{T_{Allowable (ASD)}} + \frac{V_{Applied}}{V_{Allowable (ASD)}} \leq 1.2$$

For water saturated concrete, these times should be doubled.

NOTES:

1. All values are for single anchors with no edge distance or spacing reduction.
2. Anchorage must be designed in accordance with ACI 318-05 Appendix D.
3. Allowable loads are for the attachment of non-structural components.
4. Allowable loads are based on 100% seismic loading in seismic design categories C-F.

Anchors have the following Code Reports:

- ICC-ES-ESR-2508 and City of Los Angeles Report RR25744 for cracked & uncracked concrete
- NSF/ANSI Standard 61 (216in² / 1000 gal)

TYPE SRA ANCHOR RATINGS BASED ON ALLOWABLE STRESS DESIGN (ASD)
installed into 2500 psi (17.2 Mpa) Normal Weight Concrete*

Type and Size	A307 Grade C Threaded Rod		A193 Grade B7 Threaded Rod		A193 Grade B6 Stainless Steel (Type 410) Threaded Rod		A193 Grade B8 Stainless Steel (Type 18-8, 304) Threaded Rod	
	Tension (in) (mm)	Shear (lbs) (kg)	Tension (lbs) (kg)	Shear (lbs) (kg)	Tension (lbs) (kg)	Shear (lbs) (kg)	Tension (lbs) (kg)	Shear (lbs) (kg)
SRA-1/2	2360 1070	1595 720	2360 1070	3440 1560	2360 1070	3410 1545	2360 1070	2325 1055
SRA-5/8	2440 1105	2540 1150	2440 1105	5475 2480	2440 1105	5425 2460	2440 1105	3700 1680
SRA-3/4	4780 2165	3735 1700	4780 2165	8095 3670	4780 2165	8015 3635	4780 2165	5465 2480
SRA-1	7830 3552	6815 3090	7830 3552	14685 6660	7830 3552	14545 6600	7830 3552	9920 4500

Seismic calculations provided in a separate document.

REVISION 1: BOLT MATERIAL WAS CARBON STEEL.



MASON INDUSTRIES, Inc.

Manufacturers of Vibration Control Products

NY Mailing Address: PO Box 410, Smithtown, NY 11787

350 Rabro Drive Hauppauge, NY 11788
631/348-0282 FAX 631/348-0279 Info@Mason-Ind.com

2101 W. Crescent Ave., Suite D Anaheim, CA 92801
714/535-2727 FAX 714/535-5738 Info@MasonAnaheim.com

Tension and Shear Values as verified by ICC Report ICC-ES-ESR-2508.



ICC Report ICC-ES-ESR-2508

Page

FM58

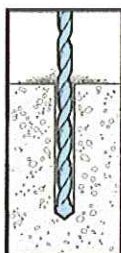
Patrick J. Lama

Patrick J. Lama
Civil Engineer
California No. 25878

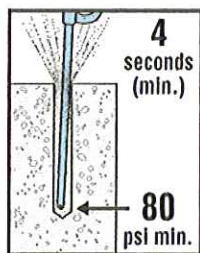
Installation Instruction for BLT500927P1

Installation Instructions for Type SRA Adhesive Anchors

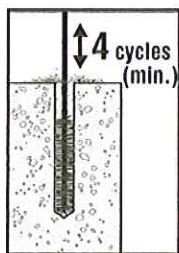
1. HOLE PREPARATION: Vertical Applications



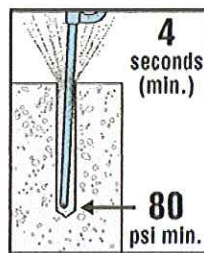
1. Drill –
Drill hole to specified diameter and depth.



2. Blow –
Remove dust from hole with oil-free compressed air for a minimum of 4 seconds. Compressed air nozzle **must** reach the bottom of the hole.



3. Brush –
Clean with a nylon brush for a minimum of 4 cycles. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.



4. Blow –
Remove dust from hole with oil-free compressed air for a minimum of 4 seconds. Compressed air nozzle **must** reach the bottom of the hole.



NOTE: Always check expiration date on product label. Do not use expired product.

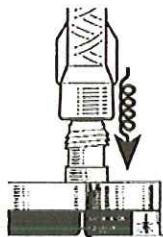


WARNING: When drilling and cleaning hole use eye and lung protection. When installing adhesive use eye and skin protection.

2. CARTRIDGE PREPARATION

1. Check –
Check expiration date on product label. **Do not use expired product.** Product is usable until end of printed expiration month.

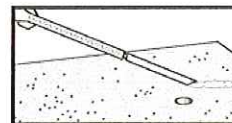
2. Open –
Open cartridge per package instructions.



3. Attach – Attach proper nozzle to cartridge. Do not modify nozzle.



4. Insert – Insert cartridge into dispensing tool.



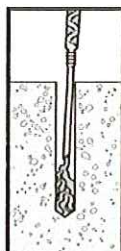
5. Dispense – Dispense adhesive to the side until properly mixed (uniform color).

3. FILLING THE HOLE: Vertical Anchorage

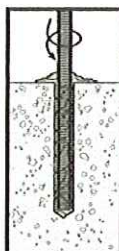
Prepare the hole per instructions "Hole Preparation".

Note: Nozzle extensions may be needed for deep holes.

Dry and Damp Holes:

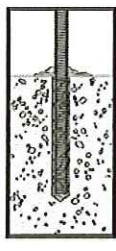


1. Fill –
Fill hole 1/2 - 2/3 full, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.



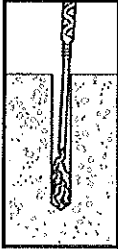
Threaded rod or rebar

2. Insert –
Insert clean, oil free anchor, turning slowly until the anchor contacts the bottom of the hole.



3. Do not disturb – Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

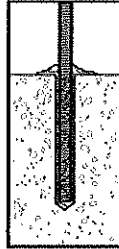
Water Filled Holes:



1. Fill --
Fill hole completely full, starting from bottom of hole to prevent water pockets. Withdraw nozzle as hole fills up.



2. Insert --
Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.



3. Do not disturb -- Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

**Threaded rod
or rebar**

WARRANTY STATEMENT

PROJECT: 16-05 WASTEWATER QUALITY CONTROL FACILITY
MANTECA - DIGESTER IMPROVEMENTS PROJECT

Hermetically Sealed Multistage Gas Blower – Specification **Section 11374**

Seller warrants to Contractor that the Materials shall conform to the specifications and drawings. Seller further warrants that the Materials will be complete in all respects necessary to make the Materials fully functional if installed and operated in accordance with the Specifications. Seller guarantees to Contractor that the Materials supplied shall be free of any and all defects in workmanship and materials which may develop within twenty four (24) months from project acceptance or thirty months from delivery of the Materials. All warranty work shall be commenced with fourteen (14) calendar days of written notice. The complete terms of the warranty are described in Exhibit A. The warranty will not exceed thirty months from delivery of equipment. With the exception of consequential, incidental, special or indirect damages, Seller accepts responsibility for all costs associated with repairing or replacing equipment. Seller and Contractor will make the repair/replace decision together.

Spencer®

Hermetic Gas Boosters

General Instructions

Caution: Do not operate machine in "Surge" or in unstable flow range for extended periods.

Spencer Service

Spencer service begins upon receipt of your request for equipment purchase. Our engineers welcome the opportunity to discuss your installation problems and will assist in determining specification requirements if so desired. To serve you promptly, we maintain an inventory of electric motors and machine parts for the various types of equipment. Also, by combining under one roof, the constantly supervised manufacturing, assembly, and test procedures, Spencer can assure you of a unit capable of optimum performance under the most severe service conditions. All Spencer gas boosters are factory tested for load capacities and noise and vibrational characteristics. This guarantees long, trouble-free operation.

Limited Warranty

Seller warrants to Contractor that the Materials shall conform to the specifications and drawings. Seller further warrants that the Materials will be complete in all respects necessary to make the Materials fully functional if installed and operated in accordance with the Specifications. Seller guarantees to Contractor that the Materials supplied shall be free of any and all defects in workmanship and materials which may develop within twenty four (24) month from project acceptance or thirty (30) months from delivery of the Materials. All warranty work shall be commenced within fourteen (14) calendar days of written notice. The complete terms of the warranty are described in Exhibit A. The warranty will not exceed thirty (30) months form delivery of equipment. With the exception of consequential, incidental, special or indirect damages, Seller accepts responsibility for all costs associated with repairing or replacing equipment. Seller and Contractor will make the repair/replace decision together.

~~Except as specifically set forth herein, Spencer makes no warranty, express or implied, with respect to the products and/or services supplied hereunder. This warranty is in lieu of and excludes all other warranties, including without limitation, any warranty of merchantability, fitness for a particular purpose, or conformance to purchaser's specifications.~~

Handling

This machine has been carefully balanced and tested at our factory. It is essential, therefore, that it be handled with care during installation in order that you may be assured satisfactory performance.

If the machine is to be stored for some time before being permanently installed, it must be carefully protected from dampness and dirt.

Location

Install the machine in a cool, dry place free from dirt and dust. After placing the machine in its operating position, be sure that the blower and motor are readily accessible for servicing by allowing several feet of clear space around the machine. Inaccessibility can prove costly in both time and labor.

Caution: Do not locate unit in excessively hot area (above 100°F).

Foundation

No special foundation is necessary for the equipment. A level concrete floor or block is recommended, although any other substantial floor will prove satisfactory. The machine and its base should be placed on the insulation pads normally furnished with it.

Caution: Gas Boosters should not be bolted down or anchored in any way.

Piping

All piping should be of ample size to minimize frictional loss. It is absolutely essential that all joints be gastight and that there be no leaks in the system. Leaky gas pipes consume a surprising amount of power and impair the operating efficiency of the machine. Piping should be properly supported without producing any stress and strain on the machine casing. It is further recommended that a suitable flexible connection be used to connect it to the piping.

Caution: If the piping system is to be leak-tested using high pressure air, be sure to either bypass or disconnect the gas booster. High pressure air will seriously damage the gas booster.

Electrical

Be sure that the motor furnished with this machine is wound for the same type of current available at the installation. Follow the wiring instructions furnished. Wire and fuses should comply with NEC and/or local codes.

It is important that proper equipment be used. All A.C. machines should be equipped with a magnetic contactor or a manual or automatic compensator depending on the machine size and the installation regulations of the local power company. The starters should have thermal overload protection as well as true low-voltage protection.

Ball Bearings

The motor ball bearings in this machine have been designed specifically for the function they must perform. Impeller loads, both radial and thrust, are carried by one of the bearings. Again, it is essential that replacement bearing be of the same type as the original bearings. In many machines, the front (opposite shaft extension) motor bearing normally has been designed to take thrust.

Lubrication

The motor bearings are factory lubricated for life. The machine must be disassembled if both front and back motor bearings are to be replaced. Consult factory for repair procedure.

Rotation

Caution: It is very important that the direction of rotation of the gas booster be the same as that indicated by the arrow plate. Correction rotation will result in rated discharge pressure. Incorrect rotation will result in less than rated discharge pressure.

Warning: Be sure all electrical power is disconnected prior to performing machine maintenance.

Instructions for Disassembly and Reassembly

Remember during disassembly that parts will be reassembled in exactly the same relative positions. Therefore, it is recommended that each part be tagged as it is removed from the machine to facilitate later reassembly. It is especially important that the location of each impeller, as well as its position on the shaft, be marked.

Disassembly

To disassemble the blower begin at the discharge end and remove in turn, the end head, the end head spacer, the discharge division head, the impeller, spacer, rope packing, deflector, impeller, spacer, and so on until all impellers are removed. The intake division head can be removed.

To remove the motor, remove intake end head and the bolts holding motor to the base.

Assembly

Bolt the motor down tightly in its original position with the shaft in the exact center of the blower casing. Run the motor to make sure that the shaft turns absolutely free. Place the first impeller on the shaft, but do not tighten it. Place deflector head back tightly against the stops, and with a suitable tool, caulk the packing firmly back into the grooves. Set the impeller midway in its chamber in such a position that the marks on the hub and shaft coincide. Tighten impeller bolts firmly. Tighten the screws securely, but evenly, taking only a few turns on each screw in succession. Place the second impeller on the shaft, but do not tighten. Place spacer into deflector head and put both together into position in the casing.

Recommended spare parts:

1. Impellers
2. Rope Packing
3. End Head Gaskets

Instructions for Balancing

When machines leave our plant there is no perceptible vibration in them. Rough handling during transportation sometimes upsets a good machine balance. When a machine is being disassembled for repairs, mark the parts as they are removed. If this is done, no trouble should be expected from vibration when they are reassembled in the same order.

However, if there is any vibration due to an unbalanced condition after assembly, contact Spencer's Service Department.

Caution: Customers should not attempt to balance a hermetic gas booster.

Trouble Shooting

If gas booster is not delivering rated pressure, but motor is not overloaded, check the following:

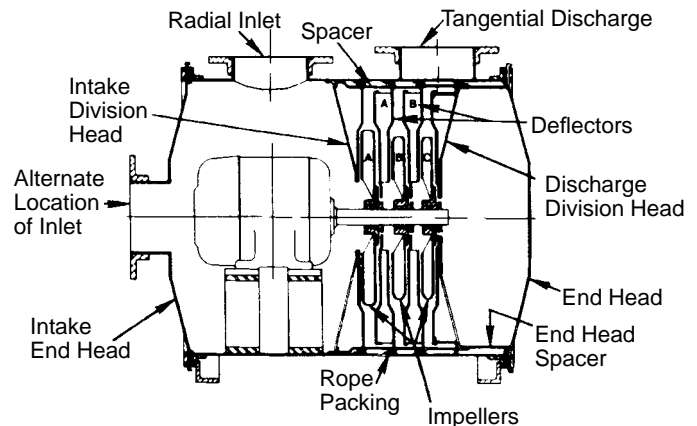
1. Correct and reversed rotation will produce two different delivery pressures, the higher pressure indicating correct rotation.
2. Interior parts clogged with dirt.
3. Piping too small and causing high frictional loss (only applies where pressure is checked at end of piping).
4. Lower specific gravity of gas than shown on nameplate.
5. High inlet gas temperature.

If gas booster is not delivering rated pressure and/or motor is overloaded, check the following:

1. Wrong voltage connections.
2. Unit handling more than rated volume because of:
 - a. Leaks in piping.
 - b. Orifices too large.
 - c. Too many orifices.
3. Higher specific gravity than on nameplate.
4. Intake gas temperature too low.

When ordering service be sure to mention serial number as shown on machine nameplate.

When ordering replacement impellers and deflector heads be sure to specify by letter also.



BALDOR • *RELIANCE*

Product Information Packet

SPENCER TURBINE CO

36H959S377G3

5HP,3470RPM,3PH,60HZ,184TYZ,3634M,XPFC,F

01/20/2017 DMPETB0
ZPDM_PDI1

Baldor Electric Company
Product Inquiry: Notes/Proprietary Information

PRD/810 Time: 08:11:22
Page: 1

Product ID 36H959S377G3 Desc 5HP,3470RPM,3PH,60HZ,184TYZ,3634M,XPFC,F Class Code CUS Matl Type FERT
ENG. 34M 2P XPFC HOR 184TYZ T'STATS, SE

Revision -	Status PRD/I	Chg # 1006196	Proprietary No
Elec Spec 36WGS377	Prod CFG 36WGS377-C001	Rating 36WGS377-R009	Mech Spec 36H959
Type 3634M	Prod Type AC MOTOR SA,WS,RA (S	CD Diagram CD0006	Layout 36LYH959
Enclosure XPFC	Mfg Plant BALDOR/FT SMITH/REC	RoHS Y	
Frame 184TYZ	Mounting F1	Poles 02	Created Date 11/29/2016
Base RG	Rotation R	Insulation F	Eff Date 12/31/9998
Leads 3#16			Replaced By
HTS 8501.52.4000	Cnty Org US	XP CL/GRP CLI GP-D	

I N - W O R K

NAME PLATE	
NP0015XPSLEV	
NO.	CC 010A
SER.	
SPEC.	36H959S377G3
CAT.NO.	
HP	5
VOLTS	460
AMPS	5.6
RPM	3470
HZ	60
SER.F.	1.15
RATING	40C AMB-CONT
FRAME	184TYZ
USABLE AT 208V	
BLANK	

Proprietary	No	Customer Part #	Customer Catalog #
Proprietary Reason			
Customer	240005	SPENCER TURBINE CO 600 DAY HILL RD. Phone: 860-688-8361	WINDSOR CT 06095 Fax: 860-688-0098

Standard Notes

- 1) SI00025495 INSTALL PHASE INSULATION IN ENDTURNS PER
S/P011-000-000
- 2) SI00025496 S/P064-000-000 SPECIAL BALANCE
- 3) SI00036608 THERMOSTAT SEE S/P093-000-000
- 4) SI00036610 MAXIMUM SHAFT RUNOUT = .001" T.I.R. PER
10" OF SHAFT LENGTH FROM SHOULDER
- 5) SI00036611 RECORD T.I.R. READING AT SHOULDER, MID-
SHAFT AND AT END ON TAG AND ATTACH TO
MOTOR EYEBOLT
- 6) SI00037555 RECORD VIBRATION READING ON T.I.R. TAG

TypeOper # Text

SI 9720 *STAPLE (2) 2X4'S TO BOTTOM OF BOX
(1 ON EA END)

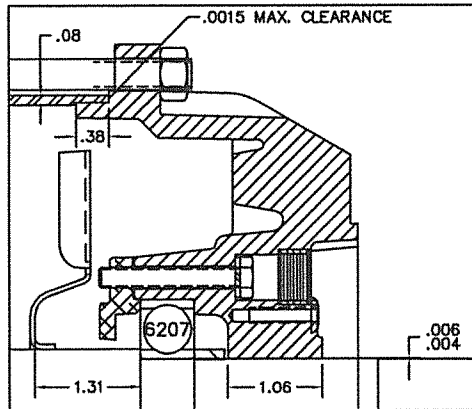
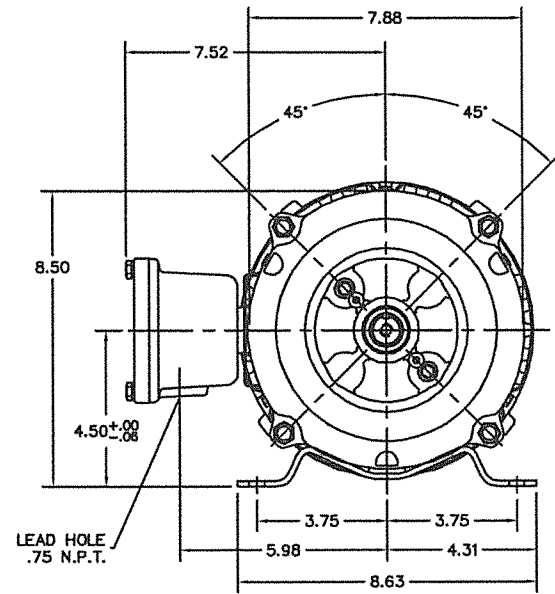
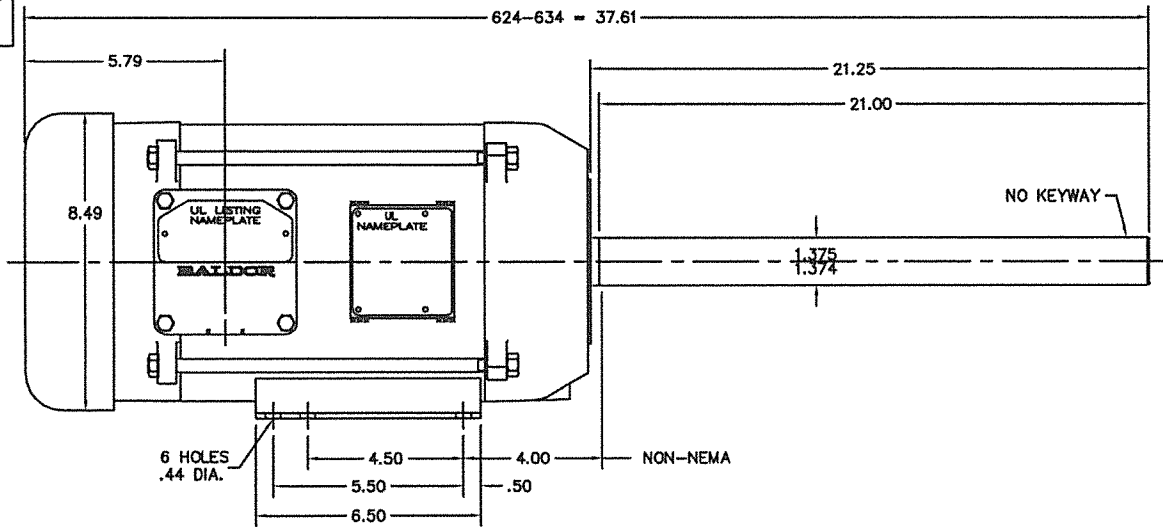
SI 9505 *OPTION G3: SUPER E
9510
9550
9680
9720

SI 9505 *OPTION G3: TEMP CODE, R009/C001
9510
9620
9680

SI 7165 *OPTION G3: HEATERS
7180
9620

SI *OPTION G3: SPL BRGS

36LYH959



PULLEY END DETAIL

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

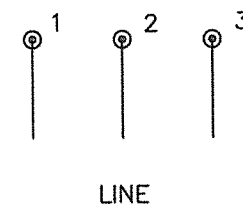
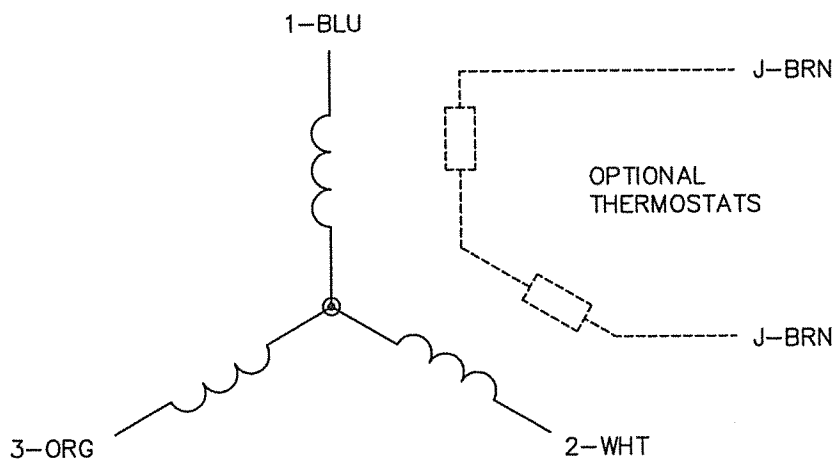
REV. DESC: REAC	VERSION: 01	TDR: 00000432135
REV. LTR: B	REVISED: 10:44:11 05/24/2007	BY: ENBRAMO
FILE: \AAA\00051\599		
MTL: -		

BALDOR ELECTRIC Co.

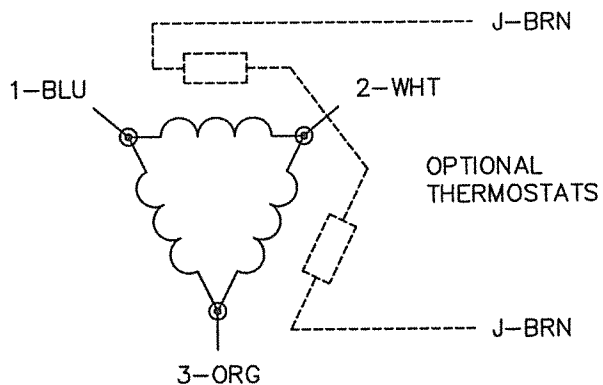
HORZ 182-4TYZ XPFC 36M CL-I GP-D U=1.375 V=21.00

36LYH959

TYPICAL WYE-CONNECTED MOTOR



TYPICAL DELTA-CONNECTED MOTOR



NOTES:

1. THREE LEAD MOTOR MAY BE EITHER WYE CONNECTED OR DELTA CONNECTED.
2. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
3. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
4. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY VARY.
5. LEAD COLORS ARE OPTIONAL. LEADS MUST BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			
REV. LTR: D	BY: JLP	REVISED: 01/21/99 4:02	TDR: 0171435
900000		FILE: AAA00005141	MDL: -
		MTL: -	

BALDOR ELECTRIC Co.

3PH, SV, 3 LEADS, WYE OR DELTA CONNECTED



**Integral Horsepower
AC Induction Motors
ODP, WPI Enclosures
TENV, TEAO, TEFC Enclosure
Explosion Proof**

Any trademarks used in this manual are the property of their respective owners.

Important:

Be sure to check www.baldor.com to download the latest version of this manual in Adobe Acrobat PDF format.

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Section 1

General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important: This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, **Do Not Proceed**. Please contact your Baldor distributor for more information or clarification.

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- IEC 34-1 Electrical and IEC72-1 Mechanical specifications
- ANSI C51.5, the National Electrical Code (NEC) and local codes and practices.

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment. Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

WARNING: Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.

WARNING: Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.

WARNING: This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.

WARNING: Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.

WARNING: Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.

WARNING: Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

WARNING: Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.

WARNING: Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.

WARNING: Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.

WARNING: Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.

Continued on next page.

Safety Notice Continued

- WARNING:** Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.
- WARNING:** Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.
- WARNING:** Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.
- Caution:** To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.
- Caution:** Do not over tension belts. Excess tension may damage the motor or driven equipment.
- Caution:** Do not over-lubricate motor as this may cause premature bearing failure.
- Caution:** Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.
- Caution:** If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20 ° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.
- Caution:** To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.
- Caution:** If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.
- Caution:** The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.
- Caution:** Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

Caution:

Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WP11 motor.
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WP11 (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate “shell” should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, whichever is greater. Minimum resistance is calculated as follows: $R_m = kV + 1$

where: (R_m is minimum resistance to ground in Meg–Ohms and kV is rated nameplate voltage defined as Kilo–Volts.)

Example: For a 480VAC rated motor $R_m = 1.48$ meg–ohms (use 5 M Ω).

For a 4160VAC rated motor $R_m = 5.16$ meg–ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
 - a. Shock or vibration must not exceed 2 mils peak-to-peak maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
 - b. Storage temperatures of 10 °C (50 °F) to 49 °C (120 °F) must be maintained.
 - c. Relative humidity must not exceed 60%.
 - d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

Note: Remove motor from containers when heaters are energized, reprotect if necessary.

3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
 - a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
 - b. Place new desiccant inside the vapor bag and re–seal by taping it closed.
 - c. If a zipper–closing type bag is used instead of the heat–sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
 - d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.
5. Motors with anti–friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
 - a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.
 - b. Ball and roller bearing (anti–friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
 - c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
 - d. “Provisions for oil mist lubrication” – These motors are packed with grease. Storage procedures are the same as paragraph 5b.
 - e. “Oil Mist Lubricated” – These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under “Standard Condition” in Section 3, then rotate the shaft 15 times by hand.

-
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
 7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.
 8. Carbon brushes should be lifted and held in place in the holders, above the commutator, by the brush holder fingers. The commutator should be wrapped with a suitable material such as cardboard paper as a mechanical protection against damage.

Non-Regreaseable Motors

Non-regreaseable motors with "Do Not Lubricate" on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreaseable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

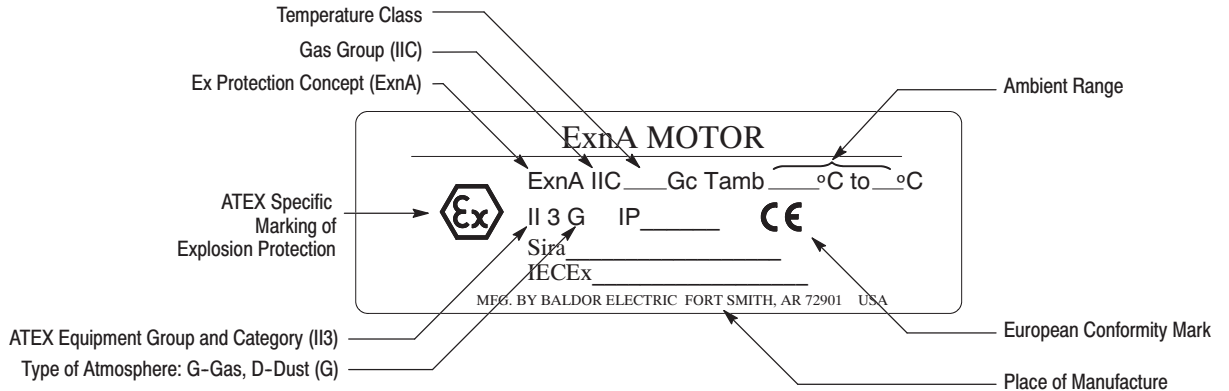
Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Equipment Marking for IEC Certified Product

IEC certified products have special markings that identify the protection concept and environment requirements. An example is shown in Figure 1-1.

Figure 1-1 IEC Certified Product Markings



Specific Conditions of Use:

If the motor certificate number is followed by the symbol "X", this indicates that the motor has specific conditions of use which are indicated on the certificate. It is necessary to review the product certification certificate in conjunction with this instruction manual.

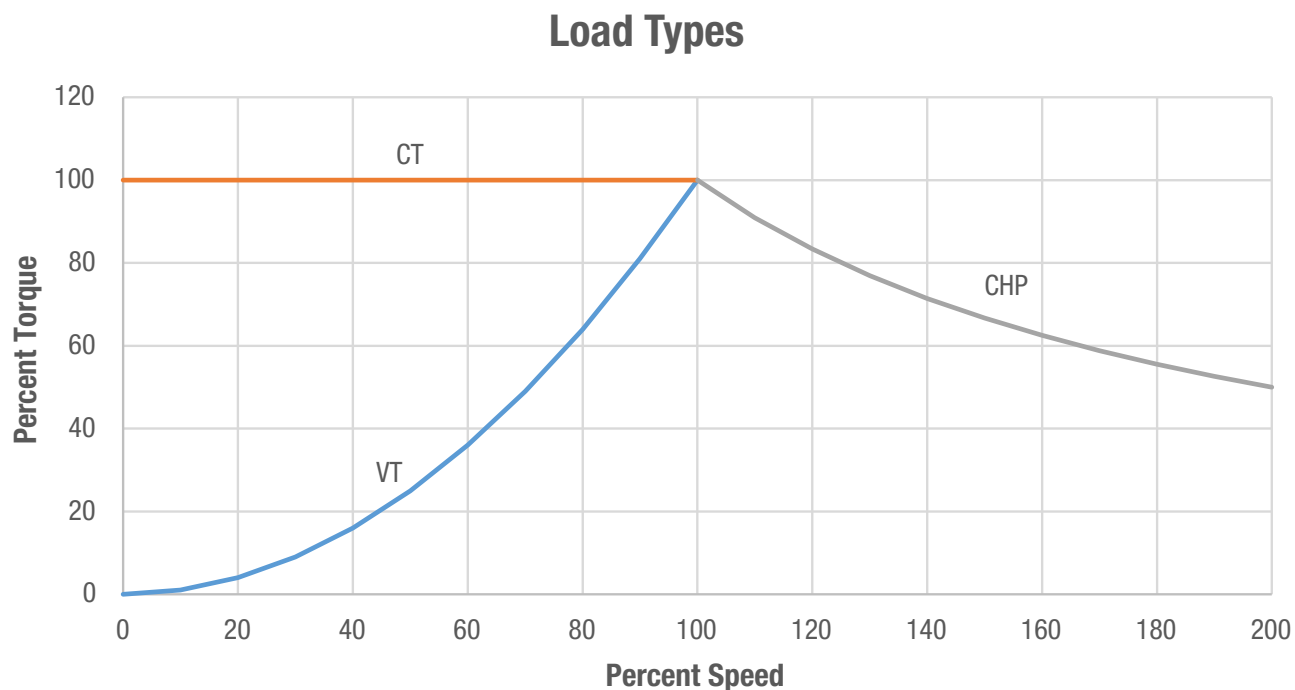
Operation On Frequency Converters:

If the motor is evaluated for operation with an adjustable speed drive, the type of converter (for example PWM for Pulse Width Modulated) and safe speed ranges (for example 0- 120Hz) will be specified in the certification documents or on motor nameplates. It is necessary to consult the adjustable speed drive manual for proper set up. IECEx Certificates are available online at www.iecex.com

Unit Conversions	
Inches to Millimeters	Inches x 25.4 = mm
Millimeters to Inches	mm x .03937 = Inches
Horsepower to Kilowatts	Hp x .746 = Kw
Kilowatts to Horsepower	Kw x 1.341 = Hp
Pounds to Kilograms	Lbs x .454 = Kg
Kilograms to Pounds	Kg x 2.205 = Lbs

Typical Speed vs Torque Curves are shown in Figure 1-2. For values relative to your specific motor, consult the motor nameplate marking.

Figure 1-2 Typical Speed vs Torque Curves



EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use. When used with converters, please consult converter manufacturers literature regarding recommendations on cable types, cable shielding, cable shielding termination, connection recommendations and any filters which may be recommended for EMC compliance. For additional information, consult Baldor MN1383.

Section 2

Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

For Group I Mining Motors where breather drains are used specified, Breather drain shall be mounted or protected in installation such that it is guarded from direct impact.”

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip–Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non–corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service. IEEE841 motors are suitable for application in Class I Division 2 and Class I Zone 2 areas on sine wave power in accordance with the applicable codes and standards.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use.

Mounting Location

The motor should be installed in a location compatible with the motor enclosure and specific ambient. To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

Table 2-1 Enclosure Clearance

TEFC / TENV (IC0141) Enclosures	
Fan Cover Air Intake	180 – 210T Frame 1” (25mm)
Fan Cover Air Intake	250 – 449T Frame 4” (100mm)
	IEC 112 – 132 1” (25mm)
	IEC 160 – 280 4” (100mm)
Exhaust	Envelope equal to the P Dimension on the motor dimension sheet
OPEN/Protected Enclosures	
Bracket Intake	Same as TEFC
Frame Exhaust	Exhaust out the sides envelope A minimum of the P dimension plus 2” (50mm) Exhaust out the end same as intake.

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

When installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

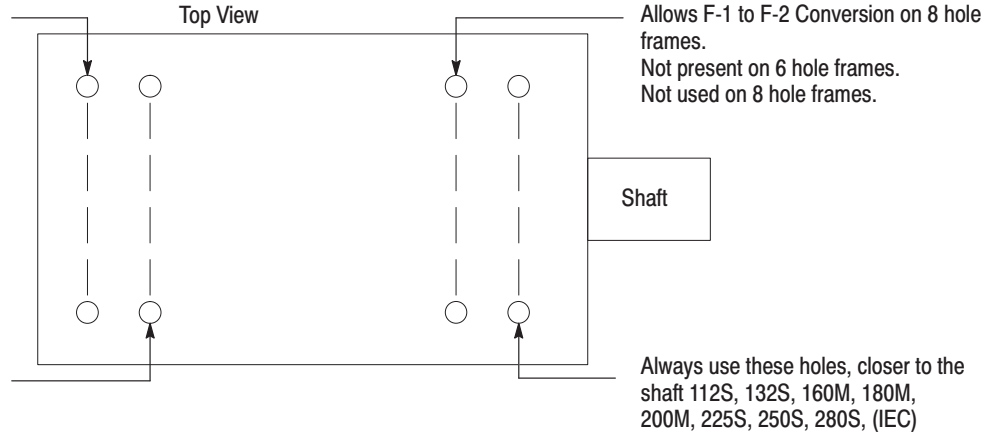
The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Frame Mounting Holes

Some motors have standardized frames containing 6 or 8 mounting holes. 6 hole frames are not suitable for field reversal of mounting from F-1 to F-2, etc. Figure 2-1 indicates the proper mounting holes to use.

For short frame designations 182, 213, 254, 284, 324, 364, 404, 444 (NEMA)

Figure 2-1 6 & 8 Hole Motor Frame Mounting



For long frame designations 184, 215, 256, 286, 326, 365, 405, 445 (NEMA)
(IEC) 112M, 132M, 160L, 200L, 225M, 250M, 280M

Caution:

Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.

In the case of assemblies on a common base, any lifting means provided on the motor should not be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. Assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. Direct Coupling

For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

2. End-Play Adjustment

The axial position of the motor frame with respect to its load is also extremely important. The standard motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.

3. Pulley Ratio

The best practice is to not exceed an 8:1 pulley ratio.

Caution:

Do not over tension belts. Excess tension may damage the motor or driven equipment.

4. Belt Drive

Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation.

This will maintain the correct motor position should motor removal be required.
(Baldor•Reliance motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment.

Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure.
Flanged nuts or bolts may be used as an alternative to washers.

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Guarding Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ExnA hazardous location motors, it is a specific condition of use that all terminations in a conduit box be fully insulated. Fully insulated and lugged terminations must be bolted and provided with lock washer to prevent rotation. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Grounding In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Crosssectional area of phase conductors, S	Minimum crosssectional area of the corresponding protective conductor, S_p
mm ²	mm ²
6	6
10	10
16	16
25	25
35	25
50	25
70	35
95	50
120	70
150	70

Equipotential bonding connection shall made using a conductor with a cross-sectional area of at least 4 mm².

Conduit Box For ease of making connections, an oversize conduit box is provided. Most conduit boxes can be rotated 360 ° in 90 ° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Motors with flying lead construction must be properly terminated and insulated.

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within $\pm 10\%$ of rated voltage with rated frequency. (See motor name plate for ratings).

OR

2. AC power is within $\pm 5\%$ of rated frequency with rated voltage.

OR

3. A combined variation in voltage and frequency of $\pm 10\%$ (sum of absolute values) of rated values, provided the frequency variation does not exceed $\pm 5\%$ of rated frequency.

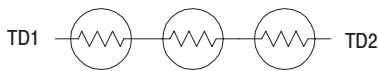
Performance within these voltage and frequency variations are shown in Figure 2-3.

HEATERS



Figure 2-2. Accessory Connections
One heater is installed in each end of motor.
Leads for each heater are labeled H1 & H2.
(Like numbers should be tied together).

THERMISTORS



Three thermistors are installed in windings and tied in series.
Leads are labeled TD1 & TD2.

WINDING RTDS



Winding RTDs are installed in windings (2) per phase.
Each set of leads is labeled 1TD1, 1TD2, 1TD3, 2TD1, 2TD2, 2TD3 etc.

BEARING RTD



- * One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.
- * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE.
- * Note RTD may have 2-Red/1-White leads; or 2-White/1-Red Lead.

Rotation

All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn-to-turn, phase-to-phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

Note: Main power leads for CE Marked Motors may be marked U,V,W – for standard configurations, please consult connection diagrams.

Caution: The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.

Connection Diagrams

AC Motor Connection Diagram

IEC VERSUS NEMA LEAD MARKING

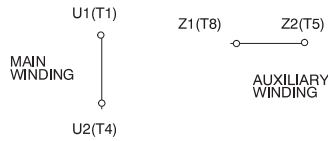
EXAMPLE COMPARISONS OF IEC AND NEMA LEADING MARKINGS FOR COMMON CONNECTION TYPES ARE SHOWN BELOW.

SINGLE PHASE MOTORS

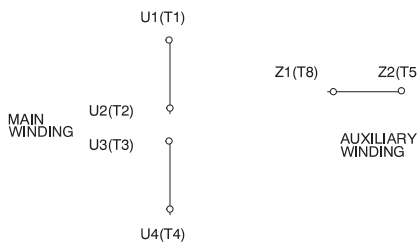
SINGLE VOLTAGE NON REVERSIBLE



SINGLE VOLTAGE REVERSIBLE



DUAL VOLTAGE REVERSIBLE



AC Motor Connection Diagram

THREE PHASE

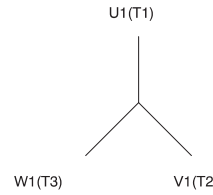
FOR SINGLE WINDING 3 PHASE MOTORS, LEAD MARKINGS CAN BE DIRECTLY TRANSLATED BETWEEN IEC AND NEMA DESIGNATIONS. FOR THESE MOTORS, THE LEAD MARKINGS ARE EQUIVALENT AS FOLLOWS:

U1=T1 U2=T4 U5=T7 U6=T10
 V1=T2 V2=T5 V5=T8 V6=T11
 W1=T3 W2=T6 W5=T9 W6=T12

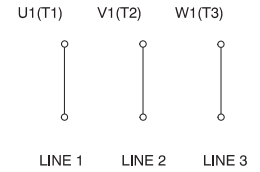
EXAMPLES OF COMMON CONNECTIONS ARE GIVEN BELOW.

THREE LEADS

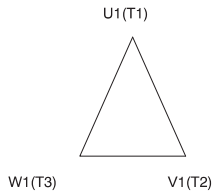
WYE CONNECT



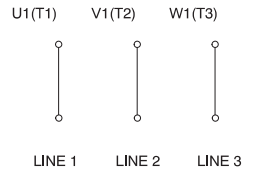
WIRING DIAGRAM



DELTA CONNECT



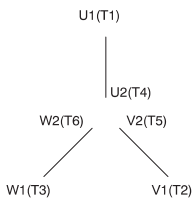
WIRING DIAGRAM



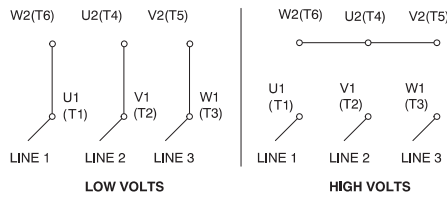
AC Motor Connection Diagram

SIX LEADS

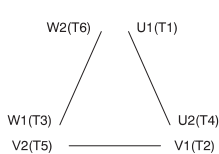
DELTA-WYE CONNECT



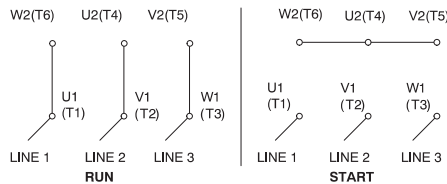
DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 1.73:1



WYE-DELTA CONNECT



WYE START-DELTA RUN SINGLE VOLTAGE

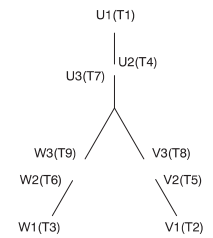


AC Motor Connection Diagram

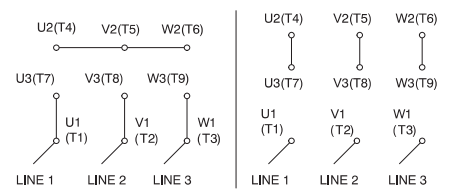
NINE LEADS

DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 2:1

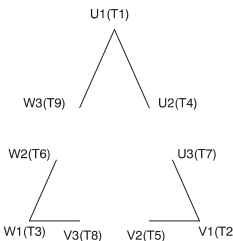
WYE CONNECT



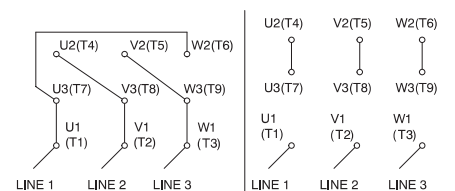
WIRING DIAGRAM



DELTA CONNECT



WIRING DIAGRAM

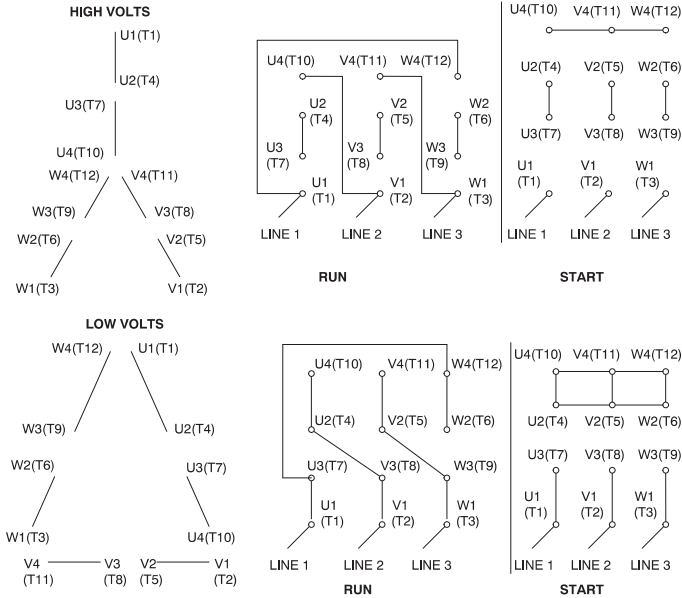


Connection Diagrams Continued

AC Motor Connection Diagram

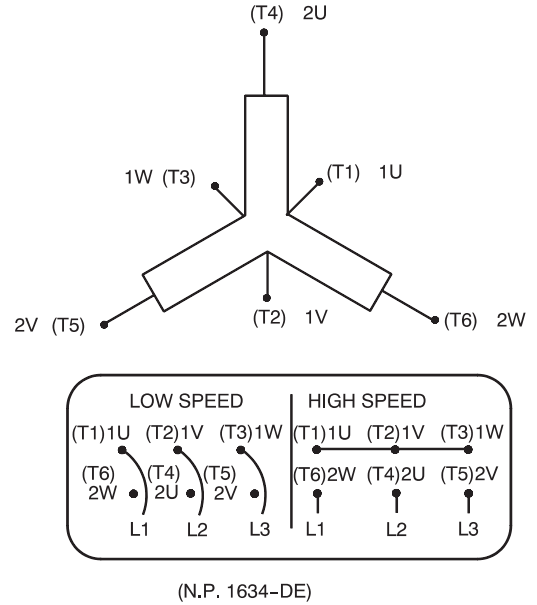
TWELVE LEADS

DUAL VOLTAGE WYE START - DELTA - RUN



AC Motor Connection Diagram

SINGLE WINDING MULTI-SPEEDS CONSTANT TORQUE



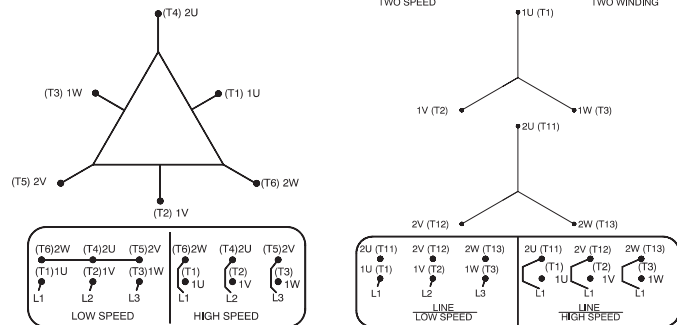
AC Motor Connection Diagram

SINGLE WINDING

MULTI-SPEEDS CONSTANT HP.

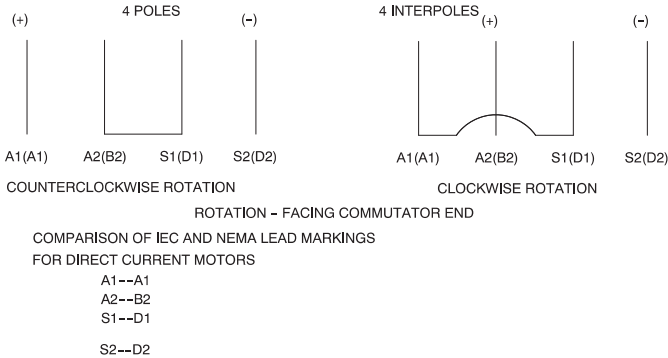
TWO SPEED

TWO WINDING



DC Motor Connection Diagram

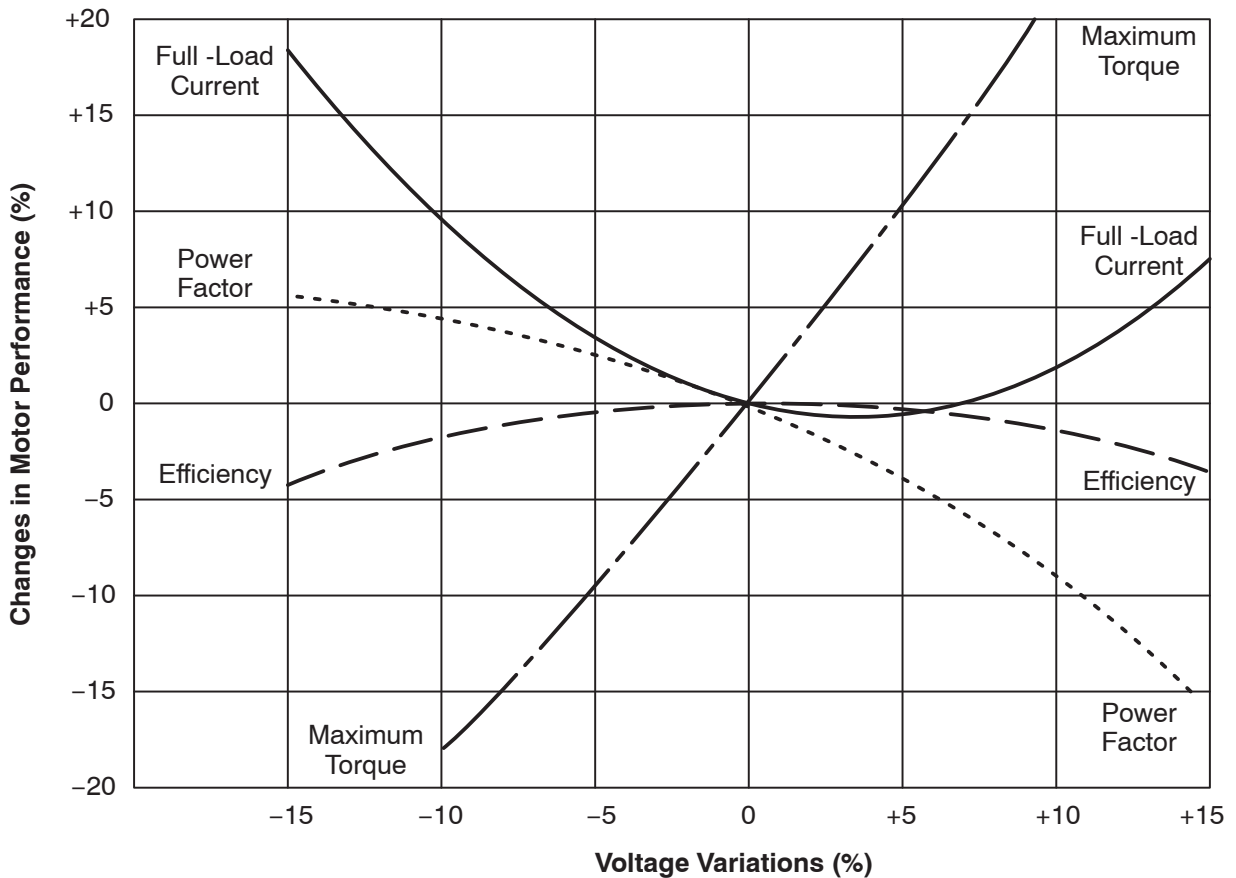
WIRING DIAGRAM TYPE "T" MOTOR



MOTOR WINDING THERMOSTATS		
CONTACTS	°C	
FIGURE NUMBER		
CONTACT RATING		
VOLTS	CONTINUOUS AMPERES	INRUSH AMPERES
110 - 120	3.0	30
220 - 240	1.5	15
440 - 480	0.75	7.5
550 - 600	0.60	6.0

THERMOSTATS	
NORMALLY CLOSED	NORMALLY OPEN
FIGURE 1 	FIGURE 4
FIGURE 2 	FIGURE 5
FIGURE 3 	FIGURE 6

Figure 2-3 Typical Motor Performance VS Voltage Variations



Initial Lubrication

Baldor•Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (6 months or more) the bearings should be relubricated (regreasable type) prior to starting. When motors are equipped for oil mist lubrication refer to the instruction manual for installation, operation, and maintenance of oil mist lubrication systems.

Caution: Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.

First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

-
11. If motor is totally enclosed fan-cooled or non-ventilated it is recommended that condensation drain plugs, if present, be removed. These are located in the lower portion of the end-shields. Totally enclosed fan-cooled "XT" motors are normally equipped with automatic drains which may be left in place as received.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor through the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts

Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Hazardous Locations

Hazardous locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers or flyings.

Selection

Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code. In international hazardous location areas, guidance for gas / vapor / mist classification is given in IEC60079-14, or for dust in IEC61241-14. This classification process lets the installer know what equipment is suitable for installation in that environment, and identifies what the maximum safe temperature or temperature class is required. It is the customer or users responsibility to determine the area classification and select proper equipment.

Areas are classified with respect to risk and exposure to the hazard. In the US market, areas are typically classified as follows Class, Division, Group and Temperature Class. In some newer installations in the US and in most international markets, areas are classified in Zones.

Protection Concepts

Class I Division 1 / Zone 1 [Equipment Group I (mining) or II (surface), Equipment Protection Level (EPL) Gb, Mb]

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment.

These motors are known as explosion proof or flameproof.

Motors that are explosion proof or flameproof use specially machined flameproof joints between the end bell or bracket and the frame, as well as along the rotating shaft and at connection box covers and entries.

The fit of these flameproof joints are designed to contain the combustion or quench the flame of an explosive gas atmosphere prior to it exiting the motor. These flameproof joints have lengths and widths selected and tested based on the gas group present in the atmosphere. Baldor•Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA 70-2008) – according to Article 500.8(C) Marking, sub clause (2) in the fine print note, it is noted that Equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations.

These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since flameproof or explosion proof motors are designed to contain the combustion and extinguish any flame transmission, for this protection concept, only external surface temperatures are of concern. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions.

When explosion proof or flameproof motors are provided with intrinsically safe sensors, the integrity of that system relies upon the proper application and selection of barriers and cables as described in the sensor manufacturers control drawing. The control drawing will be shipped with the motor, and it is important that those instructions be provided to the equipment installer.

If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device. The ATEX directive requires that motor shutdown on thermal trip be accomplished without an intermediate software command. Where intermediate circuitry is involved the circuit shall fall within the scope of a safety, controlling and regulating device as defined in article 1(2) of European Directive 94/9/EC, and shall be covered by an appropriate EC Type Examination Certificate.

Flameproof motors, internationally referred to as Ex d use a protection concept similar to that used in Class I Division 1 motors, with minor differences in the flameproof joints and cable entry designs. Flameproof and explosion proof motors are both type tested. Representative motors are connected to a reference gas and ignited in laboratory conditions to verify that the flame is not transmitted outside the motor enclosure and to determine the maximum internal pressure encountered.

Explosion proof and Flame proof motors shipped without a conduit box require use of a certified box of suitable dimensions and that is appropriate for the classification. Openings in connection boxes must be closed with suitably certified and dimensioned device.

Hazardous location motors equipped with NPT pipe nipples are designed and built such that the pipe nipple is securely attached to the motor frame. This is accomplished externally by interference between the threads as well as tack welding. The conduit box is securely attached to the pipe nipple at the factory per:

1. Standard Commercial NPT & Explosion Proof IEC/ATEX parts : L-1 gauging notch +/- 1 thread (ref. ANSI/ASME B1.20.1 and Clarification Sheet ExNB/98/06/010/CS) Note: Clarification Sheet ExNB/98/06/010/CS provides inspection criteria to meet (6 threads minimum per engineering part drawing for ATEX parts).
2. Explosion Proof UL conduit boxes & MSHA parts: L-1 gauging notch "+1 min to + 3 1/2 max threads. Note: Provides inspection criteria to meet (5 threads minimum per engineering part drawing for MSHA parts and meet UL 1203 requirement for L-1 gauging notch flush to + 3 1/2 max threads).

This allows the end user to position the conduit box according to the application then secure when in place. For obvious reasons having the conduit box snug prior to affixing to the pipe nipple is preferable. However, the guidance in numbers 1 and 2 above can be used in determining thread engagement.

Note: In the United States most non-mining applications have rigid conduit for cabling, therefore not tack welding the conduit box to the pipe nipple is standard. In markets outside the United States, flexible conduit/cabling are common and end users should take note to secure the conduit box to the pipe nipple once in position. Further, the flexible leads should be secured to inhibit forces acting on the conduit box.

Class I Division 2 / Zone 2 Ex nA, [Equipment Protection Level (EPL) Gc]

This protection concept relies on having no sources of ignition present such as arcing parts or hot surfaces. For this protection concept, internal temperatures as well as external temperatures are considered. In many cases, the internal temperatures are higher than the external temperatures and therefore become the limiting factor in determination of temperature code designation. In these applications, it is very important to use a motor that has been evaluated thermally for use with an inverter or converter, if variable speed operation is desired. Thermostats used for Class I Division 2 and Ex nA motors are used to protect the motor only. For motors using flying lead construction, it is important to use connection lugs and insulate with heat shrink tubing or a double wrap of insulation grade electrical tape to avoid the risk of spark or ignition.

Class II Division 1 / Zone 21 [Equipment Group III, Equipment Protection Level (EPL) Db]

This area classification is one where the risk of ignitable concentrations of dust is present at all or some of the time. The protection concepts used for Class II Division 1 is similar to flamepath, except with additional dust exclusion paths designed for the rotating shaft. In the international designations, this concept is referred to as dust ignition proof or Ex tD. External surface temperature remains the limiting factor. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions. If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device.

Note: In the North American area classification system, Class III exists for fibers and flyings. In the IEC designation, both dusts and flyings are absorbed into Group III.

Class II Division 2 / Zone 22 [Equipment Group III, Equipment Protection Level (EPL) Dc]

This area classification is one where the risk of exposure to ignitable concentrations of dust are not likely to occur under normal operating conditions and relies heavily on the housekeeping practices within the installation.

Sine Wave Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location.

These motors are designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded. If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

-
1. Motor load exceeding service factor nameplate value
 2. Ambient temperatures above nameplate value
 3. Voltages above or below nameplate value
 4. Unbalanced voltages
 5. Loss of proper ventilation
 6. Altitude above 3300 feet / 1000 meters
 7. Severe duty cycles of repeated starts
 8. Motor stall
 9. Motor reversing
 10. Single phase operation of polyphase equipment
 11. Variable frequency operation

Variable Frequency Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22

Hazardous Location (motors with maximum surface temperature listed on the nameplate).

Only motors with nameplates marked for use on inverter (variable frequency) power, and labeled for specific hazardous areas may be used in those hazardous areas on inverter power. The motor is designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate.

Failure to operate the motor properly can cause this maximum surface temperature to be exceeded.

If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperature above nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Unstable current wave forms
10. Lower than name plate minimum carrier frequency

Thermal Limiting

Thermal limiting devices are temperature sensing control components installed inside the motor to limit the internal temperature of the motor frame by interrupting the circuit of the holding coil of the magnetic switch or contactor. They are required for most Division 1 and Zone 1 applications. For Division 2 or Zone 2 applications, motors should be selected that preclude running temperatures from exceeding the ignition temperatures for the designated hazardous material. In Division 2 or Zone 2 classified locations, thermal limiting devices should only be used for winding protection and not considered for limiting all internal motor temperatures to specific ignition temperatures.

Equipotential Bonding and Shaft Current Reduction

Larger motors (ie WP construction) may require proper bonding between motor enclosures and covers to avoid the risk of stray currents during start up. Fastening methods and bonding straps must not be modified. Bearing currents can exist in some motors for both line-fed and inverter-fed applications. Larger line-fed motors may require at least one insulated bearing to prevent a flow of current through the bearings. Do not defeat such insulation whether the motor is line-fed or inverter-fed applications. Inverter-fed motors may require additional bearing insulation or even a shaft brush. Do not defeat such features. When the motor and the coupled load are not on a common conductive baseplate, it may also be necessary to electrically bond together the stationary parts of the motor and the coupled equipment.

Repair of Motors used in Hazardous Locations

Repair of hazardous certified motors requires additional information, skill, and care. It is the customer's responsibility to select service shops with proper qualifications to repair hazardous location motors. Contact the manufacture for additional repair details. Use only original manufacturer's parts.

Repair of Explosion Proof or Flame Proof Motors Class I Division 1 and Zone 1

In the North American market, recertification programs are offered by Underwriters Laboratories and Canadian Standards Association which allow authorized service shops to mark the rebuilt motors as certified. In the international markets using IEC based requirements, repair should be undertaken only after consulting IEC60079-19 Explosive Atmospheres-Part 19 Equipment repair, overhaul and reclamation. If use of a certified repair facility is desired, consult the IECEx Repair Scheme at http://www.iecex.com/service_facilities.htm

Explosion proof and flameproof motors achieve their safety based on the mechanical construction – flameproof joints and bearing clearance, and the electrical design including any thermal limiting devices. If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult Baldor Electric Company for flameproof joint construction details.

Use only Baldor•Reliance supplied parts. Baldor does not recommend reclamation of parts.

Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present.

Repair of Dust Ignition Proof Motors – Class II Division 1 and 2, Zone 21 and 22.

For Dust Ignition Proof, proper sealing is required. Do not modify the motor construction to add any additional opening, and ensure that proper sealing is maintained in the connection box and at the shaft seal. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present

Repair of Class I Division 2 and Zone 2 motors

For Division 2 and Zone 2, the internal and external temperatures are of concern. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present. Use only Baldor replacement thermostats, if provided.

Section 3

Maintenance & Troubleshooting

WARNING: UL and EX Listed motors must only be serviced by UL or EX Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Perform a dielectric with stand test periodically to ensure that the integrity of the winding insulation has been maintained. Record the readings. Immediately investigate any significant decrease in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Baldor motors are pregreased, normally with Polyrex EM (Exxon Mobil) or as stated on the nameplate. Do not mix greases unless compatibility has been checked and verified.

Ball Bearing Motors

Operating Temperature –25 °C (–15 °F) to 50 °C (120 °F)

EXXON	POLYREX EM (Standard on Baldor motors)
EXXON	UNIREX N2
EXXON	BEACON 325
CHEVRON OIL	SRI NO. 2 (Compatible with Polyrex EM)
CHEVRON OIL	BLACK PEARL
TEXACO, INC.	PREMIUM RB
TEXACO, INC.	POLYSTAR
AMOCO	RYKON # 2
PENNZOIL	PENNZLUBE EM–2
DARMEX	DARMEX 707
DARMEX	DARMEX 711
PETRO–CANADA	PEERLESS LLG
SHELL OIL	DOLIUM BRB

Minimum Starting Temperature –60 °C (–76 °F)

SHELL OIL CO.	AEROSHELL 7 (Standard on Baldor motors)
MOBIL	MOBIL 28
MOBIL	MOBILITH SHC 100 (Low Temperature – Arctic Duty)

Roller Bearing Motors

Operating Temperature –25 °C (–15 °F) to 50 °C (120 °F)

TEXACO, INC.	PREMIUM RB
MOBIL	MOBILITH SHC 220 (Standard on Baldor motors)
CHEVRON OIL	BLACK PEARL

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-2 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 449 incl. (315)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.

For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40 °C	Clean, Little Corrosion
Severe	16 Plus	50 °C	Moderate dirt, Corrosion
Extreme	16 Plus	>50 °C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29 °C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the “Large” bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in ³	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–355)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–355)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain its UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43 °C and the atmosphere is moderately corrosive.

1. Table 3-2 list 9500 hours for standard conditions.
2. Table 3-3 classifies severity of service as “Severe”.
3. Table 3-5 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Shaker Duty Motors only

Caution: Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Table 3-6.

Lubrication should be performed before Start Up and at regular maintenance intervals. Follow these recommendations to ensure proper lubrication.

Recommended Lubricant

For ambient temperatures between -15 °F to 120 °F the following lubricants are recommended: Mobil PolyrexEM, Texaco Premium RB, Exxon Unirex N-2.

Do not mix greases unless compatibility has been checked and verified.

Table 3-5 Lubrication Volume

NEMA Frame Size	Volume in Cubic Inches					
	Normal Duty		Severe Duty		Extreme Duty	
	Start Up	Relub	Start Up	Relub	Start Up	Relub
184TY	1.4	0.5	1.4	0.5	2.7	0.5
215TY	1.6	0.5	1.6	0.5	4.5	1
256TY	7	1			11	2
286TY	9	1			15	3

Lubrication Frequency

Normal Duty 8 hours per day (16 hours per day in a clean environment). Lubricate every 2 months.

Severe Duty 16 hours per day or more in a dirty environment (corrosive atmosphere, chemical fumes, acids, alkalies or extreme high humidity). Lubricate every month or 700 hours of operation.

Extreme Duty operation in extremely dirty or dusty environments and high ambient temperatures exceeding 104 °F (40 °C). Lubricate twice a month or 350 hours of operation.

Lubrication Procedure

1. Locate the grease inlet and outlet. Clean the areas.
2. Remove the plug(s) and install a grease fitting in the inlet if grease fitting is not already installed.
3. Add the recommended amount of lubricant.
4. Run the motor for two hours with the outlet plug removed.
5. Install outlet plug.

Note: To loosen hardened grease it may be necessary to insert a rod or wire into the grease inlet and outlet holes.

Table 3-6 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage. Eccentric air gap.	Check input line connections. Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings. Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately 3/4 filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately 3/4 filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately 3/4 filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked and repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately 3/4 filled.

Suggested bearing and winding RTD setting guidelines for Non-Hazardous Locations ONLY

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80 °C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Table 3-7 Winding RTDs – Temperature Limit In °C (40 °C Maximum Ambient)

Motor Load (Typical Design)	Class B Temp Rise ≤ 80 °C		Class F Temp Rise ≤ 105 °C		Class H Temp Rise ≤ 125 °C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod-Express.

When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Table 3-8 Bearing RTDs – Temperature Limit In °C (40 °C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Notes: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.

** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants include the following:

- Texaco Polystar
- Rykon Premium #2
- Chevron SRI #2
- Mobilith SHC-100
- Pennzoil Pennzlube EM-2
- Chevron Black Pearl
- Darmex 707
- Darmex 711
- Petro-Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.

Contact Baldor application engineering for special lubricants or further clarifications.

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FAX: 586-978-9969

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www.baldor.com

Flexi-Hinge® Valve Co., Inc.

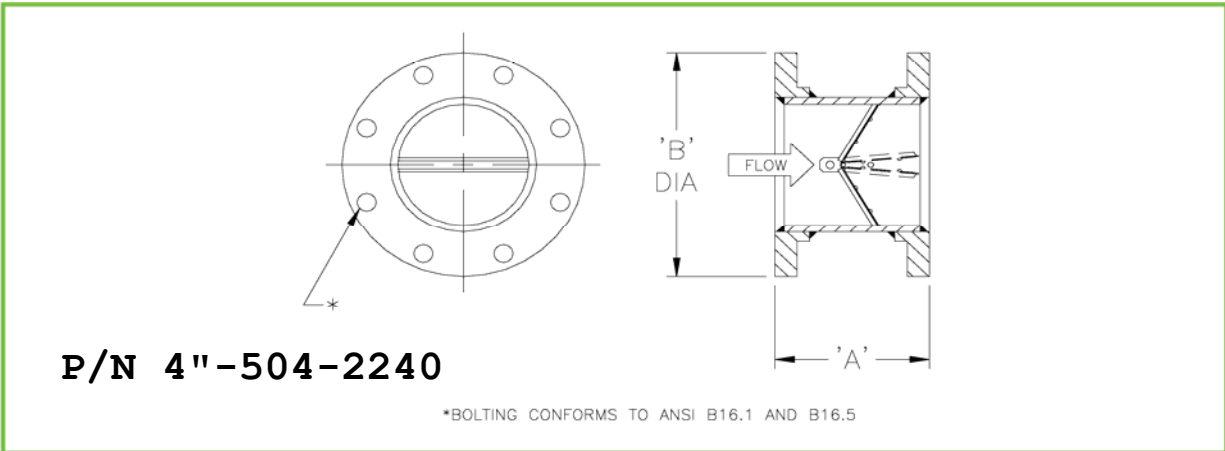
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Series 504 Flexi-Hinge® Check Valve 125# FLANGED ENDS



P/N 4"-504-2240

*BOLTING CONFORMS TO ANSI B16.1 AND B16.5

SPECIFICATIONS					
SIZE [mm]	MODEL NO.	A [mm]	B [mm]	Weight -lbs. [Kg.]	Cv [l/m]
1" [25]	-504	3" [76.2]	4-1/4" [107.9]	4.5 [2.0]	37 [140]
1-1/4" [32]	-504	4-1/2" [114.3]	4-5/8" [117.4]	6.0 [2.7]	65 [246]
1-1/2" [40]	-504	4-1/2" [114.3]	5" [127.0]	7.5 [3.4]	91 [345]
2" [50]	-504	4-1/2" [114.3]	6" [152.4]	12.5 [5.7]	160 [606]
2-1/2" [65]	-504	5" [127.0]	7" [177.8]	19 [8.6]	410 [1552]
3" [80]	-504	5" [127.0]	7-1/2" [190.5]	22 [10.0]	620 [2346]
4" [100]	-504	5 1/2" [139.7]	9" [228.6]	31 [14.1]	965 [3652]
5" [125]	-504	6" [152.4]	10" [254.0]	37 [16.8]	1510 [5716]
6" [150]	-504	7" [177.8]	11" [279.4]	53 [24.1]	3025 [11448]
8" [200]	-504	9" [228.6]	13-1/2" [342.9]	86 [39.1]	5195 [19661]
10" [250]	-504	11" [279.4]	16" [406.4]	127 [57.7]	7345 [27804]
12" [300]	-504	13" [330.2]	19" [482.6]	210 [95.5]	9450 [35772]

Note: Dimensions subject to change. Request certified drawings.

AVAILABLE MATERIALS			
BODY		INTERNALS	
-1	Carbon Steel	2	316 S/S Steel
-2	316 S/S Steel	3	Aluminum
-3	Aluminum		
-4	Cast Iron		

Standard hardware is 316 S/S
Standard seal material is Buna-N

Seals		Options	
1	Buna-N	0	No Spring
2	EPDM	1	S/S Spring
3	Silicone	2	Special
4	Viton		

(1) See general catalog for temperature limitations

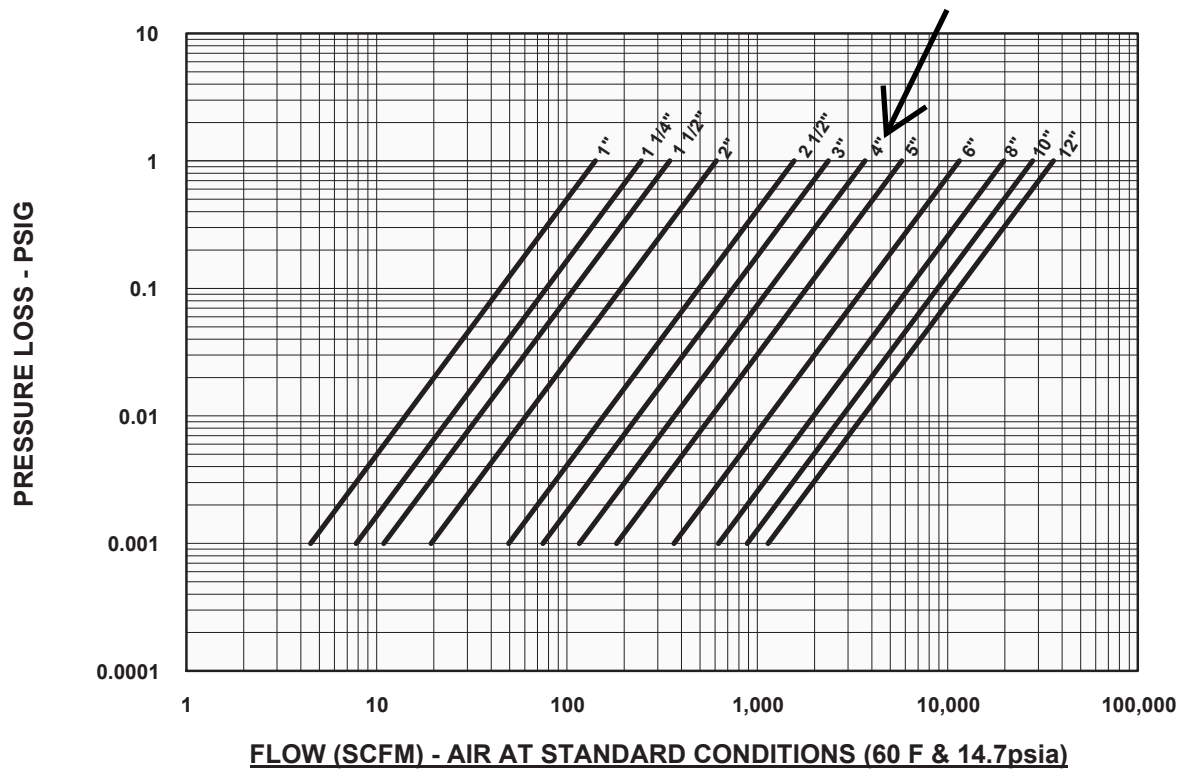
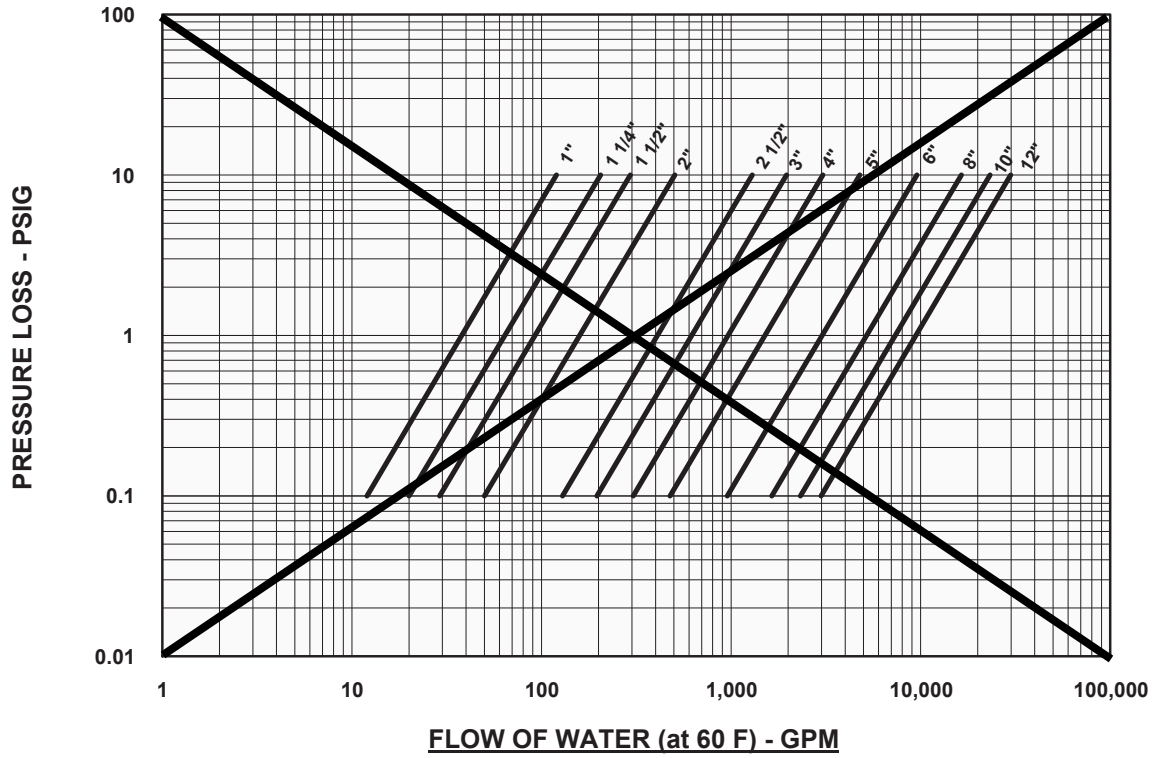
Note: Maximum Working Pressure is 200 psi at 150°F

Consult Factory for Sizes, Materials, Pressure Ratings and Combination End Configurations Not Shown

April 2011

PRESSURE LOSS CHARTS WATER AND AIR APPLICATIONS

[SEE TECHNICAL SECTION FOR OTHER LIQUIDS AND GASES]



3. INSTALLATION CONSIDERATIONS

3.1 FUNCTIONAL CHECK

Before installation, the movement of the valve plates should be checked for free operation. Move the plates manually from fully closed to fully open positions, noting any significant binding or interference. Some “drag” is normal due to the nature of the sealing member. Additionally, the valve plates may appear not to seat tightly, this also is normal, and is due to the stiffness of the sealing member conforming to the body bore. This condition will moderate as the valve cycles during service. If any significant interference is noted, the factory should be contacted for additional information on how this can be corrected.

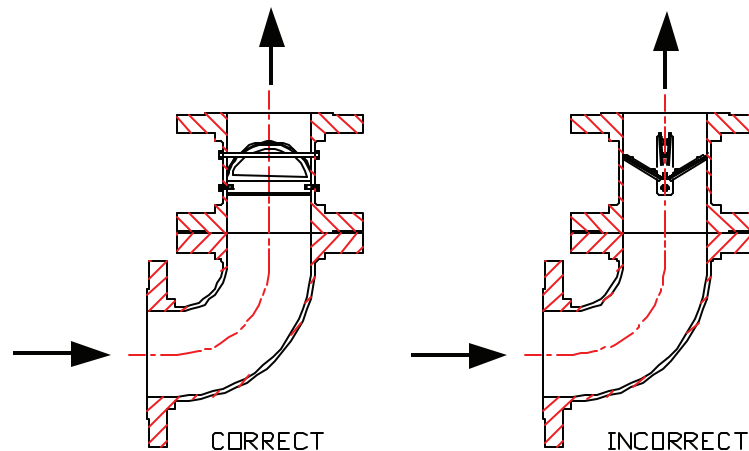
3.2 NAMEPLATE RATING

Prior to installation, check that the rating indicated on the valve nameplate conforms to the system pressure and temperature maximums. **Do not exceed the check valve ratings.**

3.3 LOCATION

A minimum of five pipe diameters between components upstream and downstream of the check valve should be maintained for proper valve operation. Insufficient space between components can result in increased maintenance and early seal failure of the check valve.

Valves installed in horizontal lines must be oriented with the “center post” in the vertical position. This can be determined by observance of the bolts mounting the internal components. Valves installed in vertical flow require no special attention to “center post” orientation. However, in the case where the check valve is positioned less than five pipe diameters downstream of an elbow, the valve must be mounted so that the “center post” is oriented parallel to the centerline of the horizontal pipe (see diagram below). Such positioning will ensure equal loading of the valve plates with respect to the velocity of the gas or liquid through the elbow.



3.4 INSTALLATION

A flow arrow on the nameplate indicates the proper direction of flow for the valve. There are various end connection styles available:

Threaded: A “strap” type pipe wrench should be utilized to install threaded end valves. Standard pipe wrenches may distort body shape and cause valve failure. Normal threaded component installation with teflon® tape is recommended, however any suitable pipe sealing paste can be used. Thread the components together until hand tight and apply an additional 1 to 1 ½ turns to attain sufficient thread contact.

Grooved: Follow pipe clamp supplier’s recommendations. Grooved valves conform to standard dimensional requirements for “Victaulic®” or other similar style pipe clamps.

Flanged: Flanges conform to ANSI B16.5 dimensions. Suitable fasteners, nuts, and gaskets are required, which conform to system specifications. Tighten bolts in accordance with standard flange bolting sequences (typical ‘star’ type pattern).

Plain: Plain end style valves are intended to be used with compatible style hose and hose clamps rated for the system pressure and temperature.

3.4 MAINTENANCE

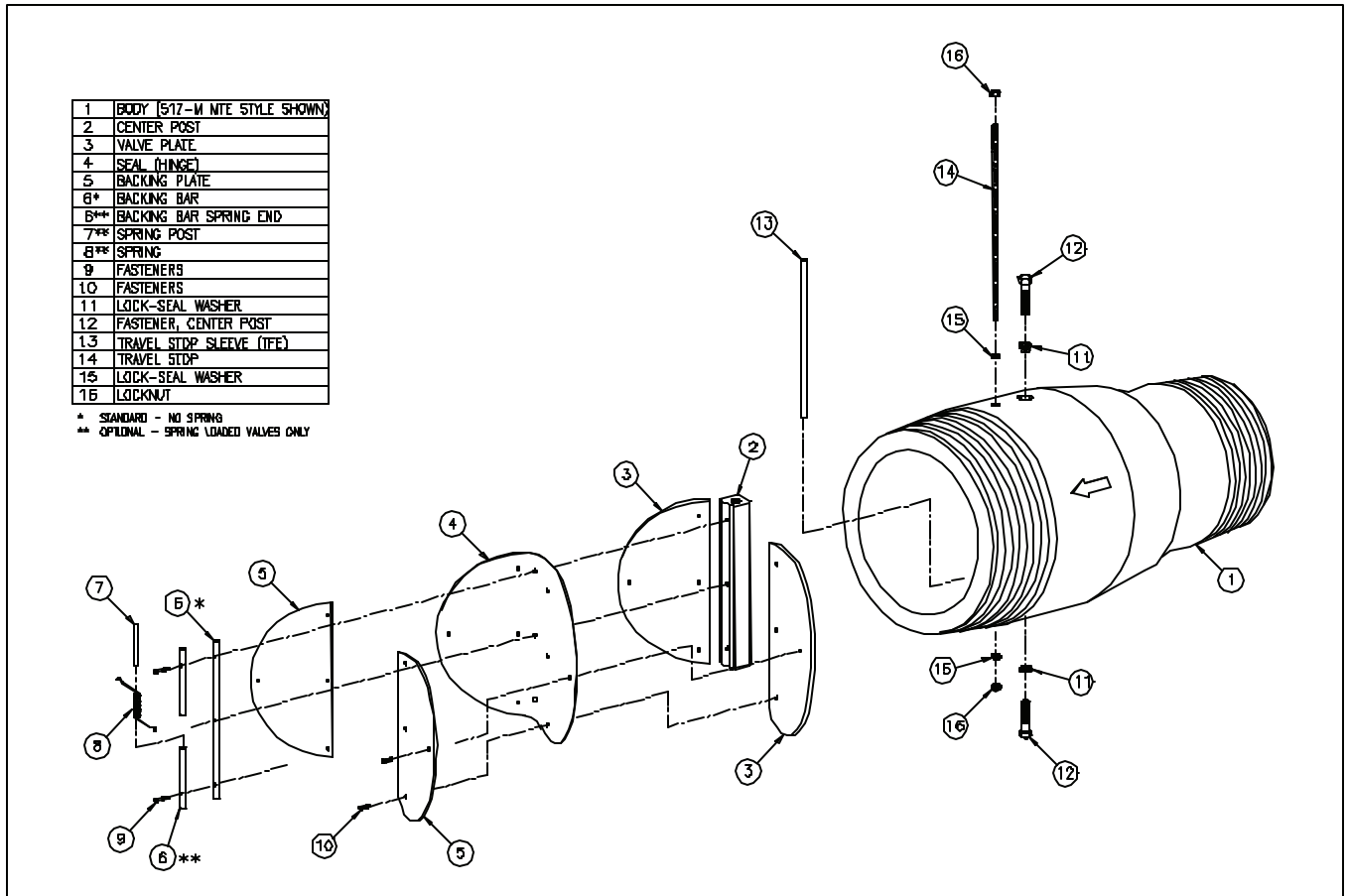
No routine maintenance is required. At suitable intervals, in conformance to system requirements, the valve seal should be checked for deterioration or wear. Replacement of seals, as with all valve components, should be scheduled as part of routine maintenance. This procedure does not require any special tools or skills and can be accomplished in the field. Attain required replacement parts and instructions from the factory when necessary. Refer to Appendix C illustration to identify the internal components and descriptions.

3.5 LONG TERM STORAGE

Valves can be stored in their original packaging. Proper care should be taken to keep the packages clean, dry, and protected from damage.

APPENDIX C

VALVE COMPONENTS, PARTS, AND DESCRIPTIONS



Note: Item 1, the body, will vary with series configuration. All other parts remain the same.

97100 Manual Drip Trap

The S&J 97100 Manual Drip Trap provides for the continuous, safe removal of condensate from low points in low pressure gas piping systems. Removing condensed liquid protects the piping and equipment from corrosion and "water hammer" damage.

The unit collects liquid until the ported rotating disc valve is manually opened. The valve seals the gas port prior to opening the drain port allowing for removal of condensate without gas escaping. The 97100 also can be provided with an optional air inlet and / or insulation jacket.

Available in either 3 or 6 quart sizes and with 1" NPT inlets and outlets, the S&J 97100 adapts to any condensation or drainage collection requirement. Its aluminum and stainless steel components withstand the severest of process environments. High and low pressure rated units allow for use in any low area of the digester gas system.

An optional timer controlled electronic actuator is available which will automatically drain the trap at a given time interval. The electronics for the timer are available in an explosion proof enclosure. Please see the 97100E for more information on the electrically actuated drip trap.

P/N 97100-62-00



Features

- Positive Gas Shut-off While Draining
- Operated Manually
- ~~5 PSI or 25 PSI~~ Pressures Available
- ~~3 or 6~~ Quart Capacities
- Internal parts and hardware Stainless Steel - Standard
- ~~Air Inlet and Insulation Jackets available~~

97100 Manual Drip Trap



Specifications:

Available Sizes/Capacity

~~3 Quart~~, 6 Quart

Inlet/Outlet Connections

1" NPT

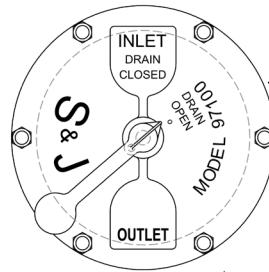
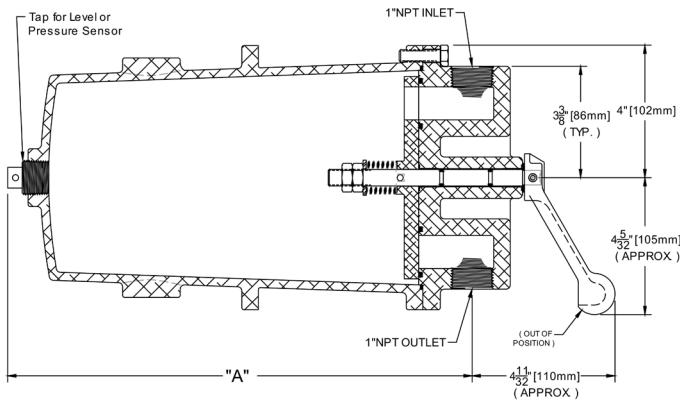
Materials of Construction

Aluminum handle, Stainless Steel Internals & Hardware
Aluminum, ~~304 Stainless Steel~~, 316 Stainless Steel
Body and Cover ~~Options~~
Buna-N ~~or Neoprene Softgoods~~

Maximum Working Pressure

~~5 or 25~~ PSIG

Dimensions:



Size	Dimensions A (Inches [mm])
3 Quart	9 1/8 [232]
6 Quart	14 1/8 [359]

All designs subject to change. Certified dimensions and specifications available upon request.

97100 Ordering Guide

Model Number Selection

The model number will have a base number **97100** followed by 4 digit numbers. These digits will represent 4 sets of option tables.

P/N 97100-62-00

97100 - AB - CD

Table A - Capacity/MAWP

Option A	Capacity	MAWP
3	3 Quart	5 PSIG
6	6 Quart	
4	3 Quart	25 PSIG
7	6 Quart	

Table C - Softgoods

Option C	Softgoods
0	Buna-N
1	Neoprene


Table B - Body Material

Option B	Material
2	Aluminum
3	Aluminum w/ Anodized Disc/Cover
4	Aluminum w/ Anodized Disc/Cover/Body
5	304 Stainless Steel
6	316 Stainless Steel

Table D - Options

Option D	Options
0	None
1	Insulation Jacket
2	Air Inlet
3	Air Inlet with Insulation Jacket



 <p>an L&J TECHNOLOGIES Company</p> <p>WASTEWATER SERVICE</p>	<p>MODEL 97100</p> <p>DRIP TRAP</p> <p>Manually Operated</p>	<p>INSTRUCTION MANUAL</p> <p>97-100</p> <p>Rev. 5.2</p> <p>6/30/07</p>
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Safety Information

Before proceeding, any addendum along with the instruction manual must be fully read and understood. Periodically throughout this manual, the words Danger, Warning, Caution and Note may occur. These are reminders to be especially careful. See the description below for more details on what each word denotes.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, “will” result in death or serious injury. This word is limited to the most extreme situations.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, “could” result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, “may” result in minor or moderate injury, or damage to the instrument being worked on.



Note: Is meant to add some measure of help or give useful information to the person working on the instrument.

⚠ WARNING

It is important to take the following precautions before you inspect or perform maintenance on the equipment.

1. Personnel installing or performing maintenance must be competent and utilize approved equipment and clothing normally used to work with the process media where the equipment is installed.
2. The piping must be at atmospheric pressure conditions and free of hazardous vapors.
3. Installation of the equipment must be done by personnel trained in all aspects of piping and mechanical assembly techniques.
4. Never exceed the pressure rating of the drip trap.

Description

The Shand & Jurs 97100 Drip Trap provides for safe removal of condensate from low points in the piping system. The hand operated version collects liquid until the ported rotating disc valve is manually opened. The valve seals the gas port prior to opening the drain port allowing for removal of condensate without gas escaping.



97100-30 Drip Trap 3/Qt. AL. w/1" Connection 97100-60 Drip Trap 6/Qt. AL. w/1" Connection

FIGURE 1

Received

This product is the property of the purchaser when it leaves our plant. Claims for damage must be made promptly with the transportation company if the shipment is received in damaged condition. Notify the agent of the transportation company at once and preserve the carton, packing material, and all contents as received.

The Shand & Jurs method of packing these goods has been proven effective by many years of experience. The transportation company has contracted to deliver this material to you in as good condition as they received it from us.

Unpack and inspect the equipment for damage upon receipt. Compare description on the identification plate against packing slip to make sure specifications are correct. After inspection, repack the unit carefully in the same manner as originally received. The unit should remain in the original shipping carton until it is ready to mount.

Installation

The Model 97100 Drip Trap is provided with a 1” NPT outlet and inlet. Connect the inlet side of the trap to the bottom connection of a sediment trap or tee it on a low point in the piping system. An isolation ball valve and union installed on the inlet piping is recommended for maintenance purposes. The outlet port should be installed with a union and piped away to an appropriate location.

Operation

The handle will point to the open port. The handle (arrow side) when pointing to the inlet (drain closed) will fill the drip trap. Rotate the handle clockwise (60 degrees) and the inlet will close and the outlet will open (drain open).

Inspection/Maintenance

Recommended minimum once a year visual examination of leakage of liquid or air bypassing the seals. In general, the O-Ring seals are the only items that need replacement every 5 years. Replace other items as required.

Replacement of Spare Parts

Disconnect and remove the drip trap from its installation before replacing the seals.

Item 1 and 2: The main shaft O-Ring Seal and turn disc seal is replaced by removing the screws holding the cover on and removing the cover assembly. Next, remove the screws holding the handle to the main shaft. Remove the handle and pull the shaft out at the spring end.

CAUTION

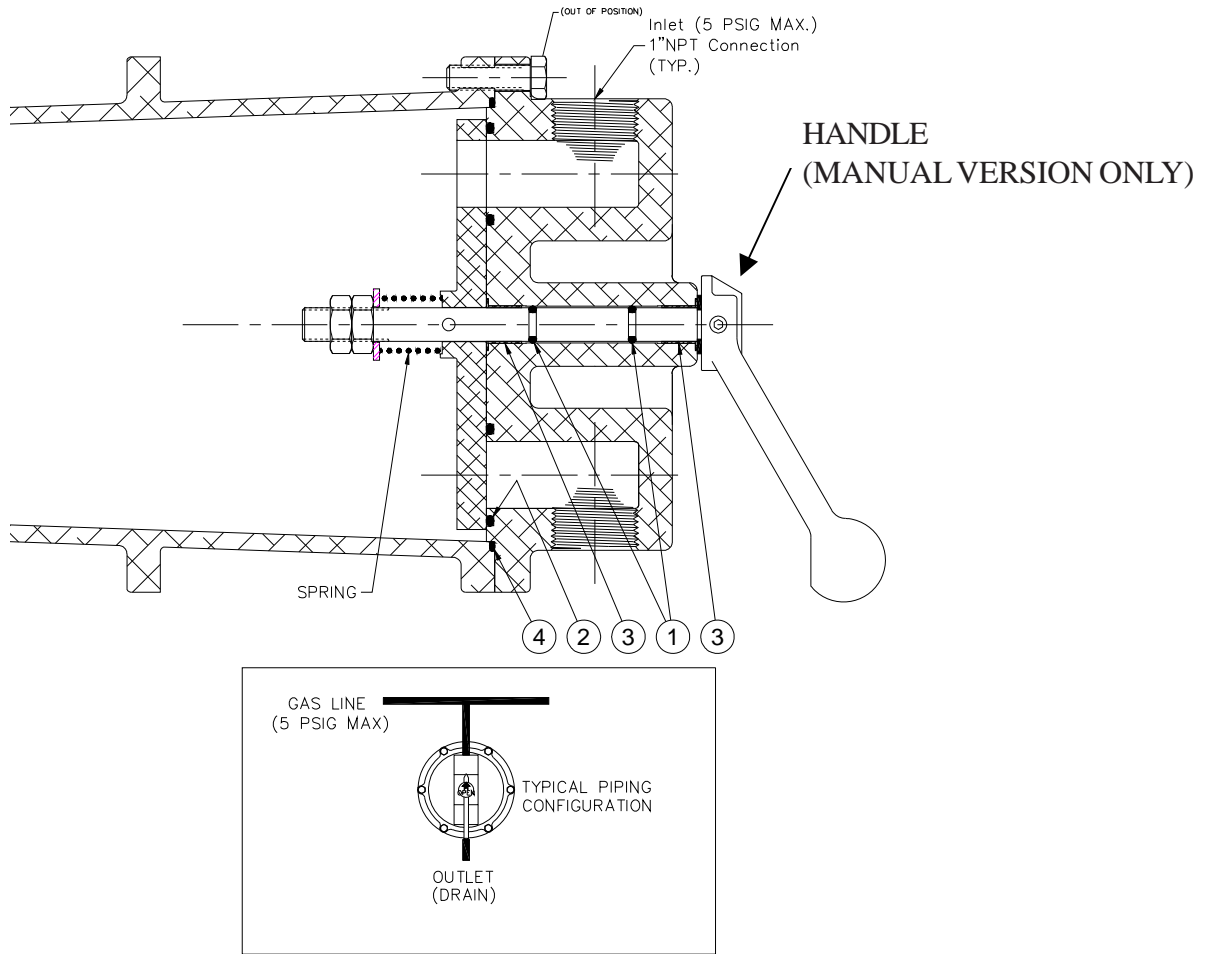
There are three (3) wear pads on the seal disc. Make sure they do not fall out during disassembly. The wear pads level the seal disc and allow a slight compression on the O-Ring for sealing. These pads are adjustable via 3 set screws, but should not need replacement or adjusting. Their purpose is to create an equal space between the seal disc and the cover (approx. 0.30).

Apply O-Ring lubricant generously on all O-Rings and shaft. Replace the shaft O-Rings. Reassemble in reverse order, and test seals using air or water. Recommended test pressure on inlet port is 5 psig. Test for leakage at outlet with handle in each position.

Item 3: If the nylon bearings are worn, replace them at this time.

Item 4: Replace the cover O-Ring at this time.

FIGURE 2



SPARE PARTS

<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>	
1	O-Ring (2)	SP76-QL (BUNA)	SP519N-QL (Neoprene)
2	O-Ring (2)	SP76-E (BUNA)	SP519N-E (Neoprene)
3	Bearing (2)	202-12 (Nylon)	
4	O-Ring (1)	544011 (BUNA)	SP519N-PJ (Neoprene)
5	Wear Pads (3)	9710-10170 (Glass filled PTFE)	

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